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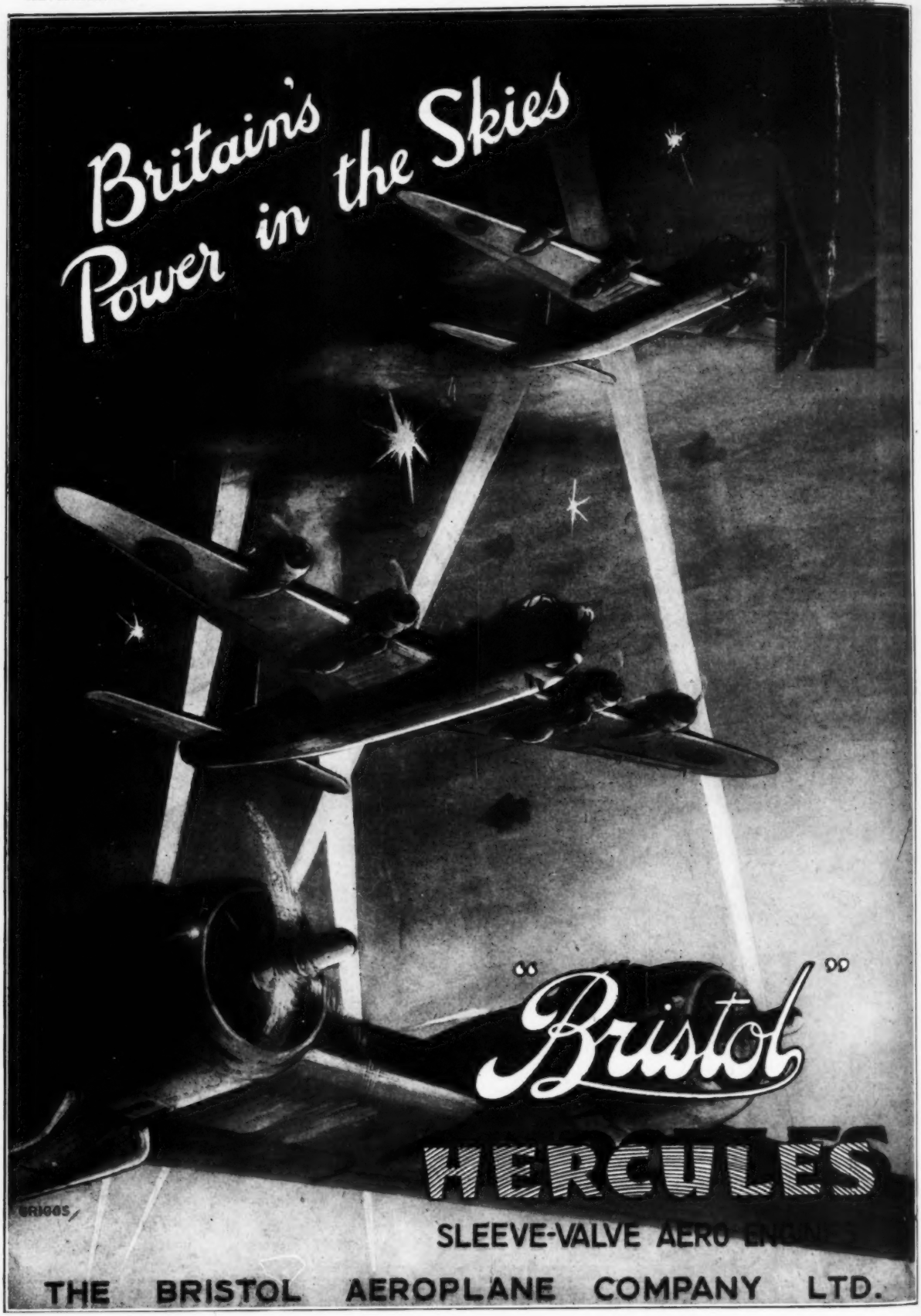
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FIRST AERONAUTICAL WEEKLY IN THE WORLD : FOUNDED 1909

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The Outlook

Defence by Light

IN the early days of the war the flare was a device mainly used by bombers to help in the attack. It illuminated the target and at the same time it partially countered the searchlights and dazzled their crews. Now it has been adopted as an item in air defence at night. This is due to the fact that night fighters have taken precedence of A.A. gunfire as the principal form of defence.

In the raid on Berlin on the last night of August, German aircraft flew above the British bombers and dropped special flares which descended slowly and illuminated the aerial battlefield. The object was to show the defensive fighters where the bombers were, and those fighters were up in great strength. Of course, the gunners in the British bombers were delighted, for they could see the German fighters coming in to attack, and accordingly a number of fighters were shot down. The nightmare of an air gunner is an attack by a night fighter which he cannot see until too late.

On the whole, however, the odds are that the raiders lost more than they gained by this latest German manœuvre. Bombers (thinking of bombardiers rather than of air gunners) like flares below them, but not flares above them. The night-bomber wants to remain in darkness, as is shown by the reluctance of Bomber Command to undertake very long flights during the short nights of summer. The defensive fighter, on the other hand, likes plenty of light. On a clear night the fighter pilot gets a better chance than on a murky one, and this applies to both sides.

Night-bombers do not fly in formation, and in combat a single bomber cannot be reckoned a match for a fighter. In other respects, too, the odds are not equal, for the destruction of one bomber is a more serious matter than the destruction of one fighter. It is the business of bombers to take risks and face losses in order to hit the target, and it is the business of fighters to do the same in order to destroy bombers. In this raid on Berlin the defence, despite its use of flares, did not succeed in its main object, namely, in saving the German capital from heavy damage. Air defence has not yet mastered air attack by night, and, as the United Nations are now the attacking side, this is fortunate. At the same time, Fighter Command is not unreceptive to new ideas, and if the enemy ever makes another night raid on London, he will doubtless have to face heavier losses than he has suffered in the past.

Sir Philip Joubert's Broadcast

FOLLOWING on the above reflections, Air Chief Marshal Sir Philip Joubert, who once commanded what was then called the Fighting Area, broadcast a war commentary in which he chose as his text the fighter aircraft. He dealt with day raids rather than night raids, and said that it almost looked as though the Fortress type of bomber had defeated the contemporary fighter, and that a new solution to the problem of defence would have to be found. He threw out a suggestion for a novel type of fighter which had not yet been produced in any country.

Sir Philip was most certainly not trying to help the Germans to extricate themselves from their present plight, in which they are suffering smashing blows from R.A.F. Bomber Command. We imagine that his mind was turning back to the days of the Battle of Britain, and was wondering what would have been the fate of this island if the *Luftwaffe* had then possessed a bomber of the Fortress type. It is fortunately true that Germany has now no chance of seizing the air initiative, and it is known that her efforts have lately been directed to increasing her fighter (i.e., her defensive) strength

even at the cost of cutting down her production of bombers.

Yet, though the United Nations are grimly determined that, for so far as human eyes can see into the future, Germany shall not again threaten the freedom of the world, victory in the present war cannot alter the facts of geography and a salient geographical fact is that Great Britain is an island. Whatever is done to Germany at the end of this war, it must remain a truth that an island kingdom is safer if air defence is stronger than air attack.

Everyone will remember the hope expressed by Mr. Churchill some time before this war broke out, that science would some day "claw the bomber down from the skies." He was then obviously thinking of what might happen when Britain was attacked from the air, and he can hardly have foreseen the almost miraculous result of the Battle of Britain. Sir Philip Joubert must also have given much thought to that subject when he commanded the Fighting Area.

At the moment the bomber is a formidable weapon in the hands of the Allies, and our interests lie in air attack. But it was not always so, and it may not always be so in the future. The bomber abolishes the advantages of insularity. If it can be "clawed down," Britain will be once again, as Tennyson said, "compassed by the inviolate sea."

General Arnold's Views

EVERYONE in Britain has been glad to welcome over here General Henry H. Arnold, chief of all the United States Army Air Forces, and to hear his opinions about the war in the air. It was no surprise to hear him say (at a recent interview) that for heavy bombers the Eighth Air Force in the United Kingdom has "No. 1 priority" on the products of American factories, or that bombers with more and heavier guns and more than twice the bomb load of the Fortresses will be ready when and where they are required. But it was interesting to hear him say that at present he is only interested in one class of fighter, namely, the escort fighter, and that he considers the P38 (Lightning) and the P47 (Thunderbolt) the best types in that class.

Most interesting of all was the opinion expressed by General Arnold that the medium bomber class will soon pass out of existence. The light bomber, he considers, will survive, and in Africa the best light bomber was, he said, a fighter. But when armies are locked in land battles, the function of the medium bomber and the heavy bomber will tend to merge, and the heavy bomber will be the more efficient for the work required.

General Arnold was presumably thinking of daylight assistance for the Army, when the bombing must be tactical. Naturally enough, British authorities have never considered machines of the Lancaster class as suitable for that sort of work, but the precision bombing of Fortresses is a different proposition. The Wellington class may go, if General Arnold is right, but we can hardly believe that there will not be work for the Mosquito class. Perhaps General Arnold would rank that as a fighter-bomber.

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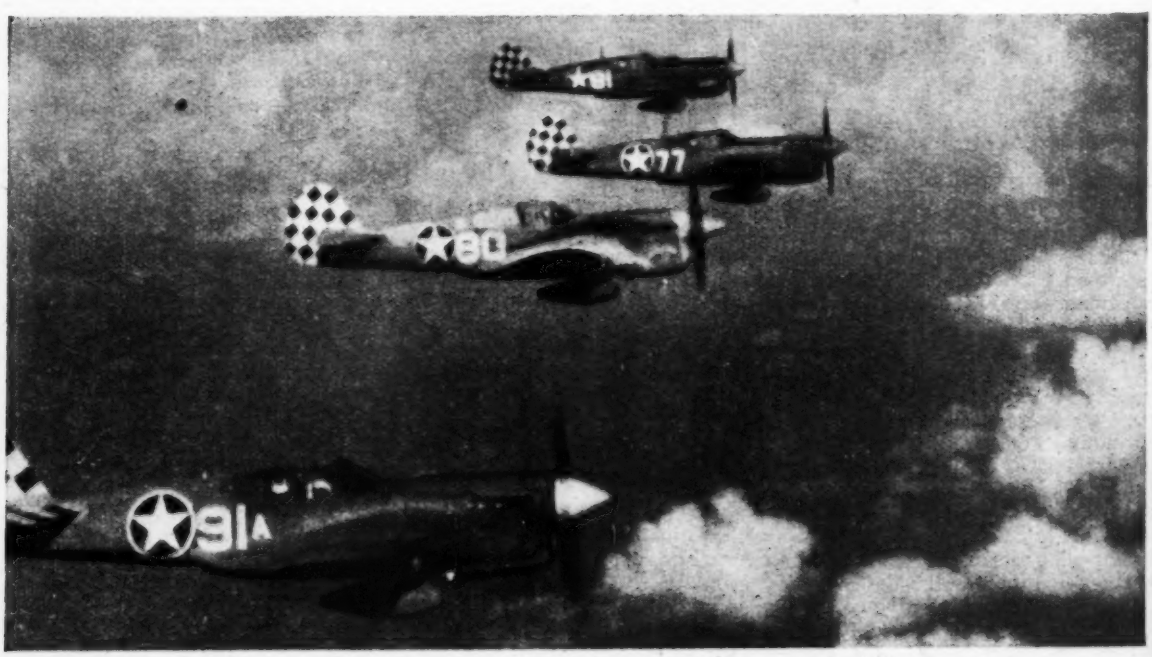
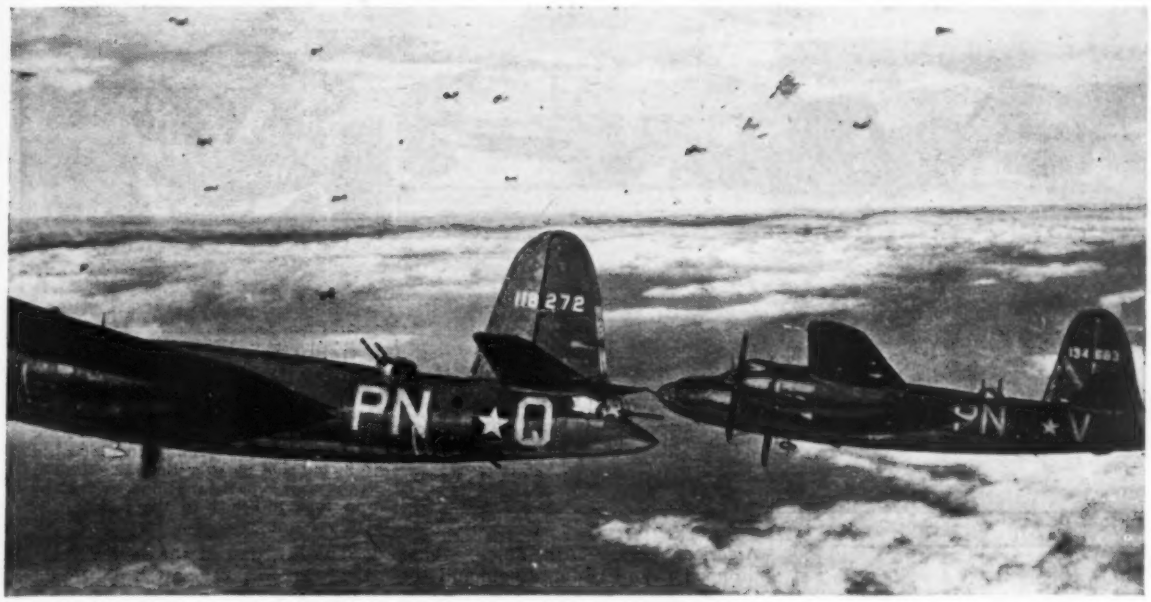


'TIS ALL A CHEQUERED BOARD : Rolls-Royce Merlin-engined Warhawks of the North-West African Air Forces. They are carrying long-range tanks in place of bombs.



U.S.A.A.F. Marauders in action over St. Omer—Fort Rouge airfield. The Marauder can carry either depth charges, torpedoes or bombs, and was first in action in the Pacific in April, 1942.

WAR in the AIR

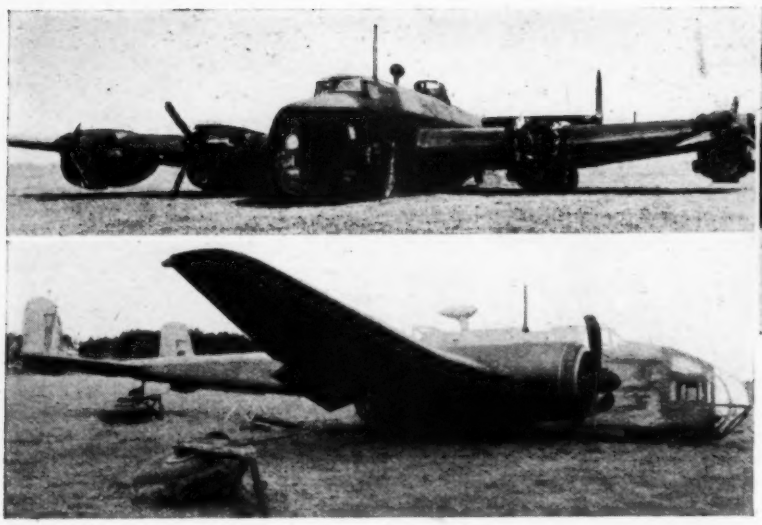
Italy Invaded : Berlin Raided Again : Carriers at Marcus Island : Wewak and Salamana

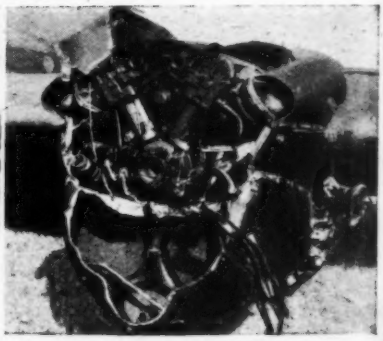
WHENEVER General Alexander wins a victory there always ensues a pause. During that pause he reorganises and makes most careful preparations for the next step forward, and he will never budge until the preparations are such as to give him a comfortable assurance that the next step forward will go as well as the last one has gone. It was so after Tunisia, and it has also been so after Sicily. During that pause, in which the public at home hears nothing of what the Army is doing, the Mediterranean Air Force under Air Chief Marshal Sir Arthur Tedder fills the news and the sky. Of course, the two men work in the closest collaboration, and Tedder is undoubtedly carrying through plans which he and Alexander have worked out together.

FOR CLOSE SUPPORT : Bombing-up a Kittybomber on a Sicilian airfield. Two 250 lb. bombs are carried side-by side on external racks under the fuselage.

After the Axis had been driven out of Tunisia, for about three weeks the aircraft ranged far and wide, attacking now here, now there, and confusing the enemy as to where the next blow would fall. In the last week they concentrated on the Sicilian airfields with such success that the landing was made without any noticeable interference by enemy aircraft. After Sicily had been cleared, the next step was to hammer all the communications between northern and southern Italy, and the Navy joined in the work of the Air Force.

Then on the morning of September 3rd, the very anniversary of the opening of the war, it was announced that British and Canadian troops of the Eighth Army, with support from the sea and air, had landed on the





HANDLEY PAGES CAN TAKE IT: (Top right) *Johnny the Wolf* arrives home after having had its inner port airscrew shot away over Essen. (Above) A close-up of the damage to the Merlin. (Left) A torpedo Hampden which had its tail shot up over Norway. Two of the crew kept the machine straight by a rope attached to the rudder bar.

WAR IN THE AIR

Italian mainland. So the die was cast.

The preliminary wrecking of Italian communications had imposed a terrible handicap on the Axis commanders, and the most formidable forts covering the Messina Straits had been reduced by the guns of the battleships *Nelson* and *Rodney*.

The calm which for so long brooded over the Allied armies in the Mediterranean was in strong contrast to the fury with which the Russians have been assailing German positions in the East. It is admitted that German divisions have been withdrawn from the Russian front to strengthen the reserve in western Europe. Faced with the possibility of having to meet invasions from both Britain and Sicily at the same time, the Germans need a powerful reserve, and they may well be speaking at least a half-truth when they say that they are glad to shorten their line in Russia. The Russians feel the relief in another way.

Another heavy attack by Bomber Command on Berlin, which was concentrated into three-quarters of an hour, produced a new form of defence by the Germans. Fighters flew above the British bombers and dropped a new type of flare. The significance of this is discussed in the leading columns of this issue.

The Air Ministry has published the fact that in the fourth year of the war no less than 96,000 tons of bombs were dropped on Germany by Bomber Command. This is nearly double the weight dropped by the R.A.F. in the three previous years put together. During the fourth year Hamburg was the recipient of 11,000 tons, Essen got 9,000, Cologne 8,000, Berlin 6,000, Duisburg 6,000, Dusseldorf 5,000, and Nuremberg 5,000. These figures do not include bombs dropped by the American Army Air Force, those dropped by Fighter Command or Coastal Command, or any dropped on occupied territory.

Pressing on Japan

MR. PATTERSON, U.S. Under-Secretary for War, is in Australia, and has promised an immediate increase in the war supplies from America. He attributed this to the good progress of shipbuilding in the States and to the diminished ratio of sinkings in the Atlantic. Perhaps another cause is the reopening of the Mediterranean to Allied shipping, which dispenses with the need to keep an enormous number of vessels steaming round the Cape of Good Hope.

At any rate, Gen. MacArthur's pressure on the Japanese is increasing. Wewak has been so continuously and so heavily bombed that the Japanese can no longer use it as a main aircraft base, and have had to move their squadrons in New Guinea farther afield, to spots where they will be less useful. They are said to have moved 200 miles back to Hollandia.

At the same time American and Australian land forces have been closing in on Salamaua, and the capture of that important air base may be announced any day—perhaps before these words are printed.

The United States Navy has also shown a growing power of taking the offensive. The Aleutian business has been cleared up, and task forces have sought fresh fields and pastures new. At least two carriers, doubtless with proper escort, attacked Marcus Island, some 875 miles to the north-west of Wake Island and only 1,250 miles from Yokohama. The Japanese have reported that the American carriers sent off about 60 bombers with an escort of 90 Grumman fighters. Marcus has been a Japanese possession for a long time, and has been a useful air base. The Americans will doubtless find it useful also in their offensive.

The last day of the fourth year of the war was celebrated by Fighter Command, which made its biggest single operation of the year. It was a day of escort duties, and Spitfires and Typhoons went out in swarms to guard bombers of the R.A.F. and of the U.S. Eighth Air Force in their attacks on targets in northern France. American squadrons of Thunderbolts also went with their Fortresses. The Germans evidently tried to avoid a pitched battle with such a strong force of fighters, and so the bombers were allowed to do their work with a minimum of disturbance. The first reports say that only four enemy aircraft were destroyed, one by Fortresses and three by Spitfires. The Allied losses were two fighters, one medium bomber and one light bomber. This indicates very few air combats.

Lock Gates Smashed

ONE of the more notable targets was the south end of the Hansweert canal, where Hurricane bombers of Fighter Command, escorted by Typhoons, destroyed the lock gates. But the whole countryside within the range of the fighters was full of Allied aircraft, and the French people must have been accordingly encouraged and the Germans correspondingly depressed.

This heavy attack, though limited in range, fits in with the blows dealt by the United Nations on all the fronts. The Germans cannot conceal from their own people the losses of important towns in Russia, though they try to represent the German withdrawals as masterly movements. The invasion of Italy likewise is a thing which cannot be hidden from the German people, and they must all be wondering how long it will be before those places in Austria and the south generally which have hitherto seemed safe will come under the bombs of British and American aircraft in Italy. The spirited rising of the Danish

WAR IN THE AIR

ENEMY AIR LOSSES TO SEPT. 4th

	Over G.B.	Con-tinent.	Middle East	N.W. Africa
Aug. 29	0	1	0	20
" 30	0	19	0	21
" 31	0	8	10	6
Sept. 1	0	0	0	0
" 2	0	3	0	34
" 3	0	3	27	5
" 4	0	17	0	12
	0	42	37	98

Totals : West, 7,390 : Middle East, over 5,666 ; North West Africa, 3,108.

people adds to the troubles of the Germans.

The Invasion of Calabria

THE first stages of the Allied invasion of the Italian mainland showed the Germans more anxious to save their own troops than to expend their lives and energies in trying to save Italy. The prisoners taken in the towns in the South were nearly all Italians, and not until the Eighth Army had firmly established its bridgeheads did enemy aircraft try to interfere with our men. When they did, they were met by a volume of A.A. fire which must have surprised them, for many A.A. guns had been hurried across the Straits with the first landings. Moreover, Reggio airfield was speedily captured and found in not too bad a condition, which could not have been counted upon beforehand. It has runways of 1,660 yards, and speedily became a useful base for British fighters. About 50 unserviceable enemy machines were found.

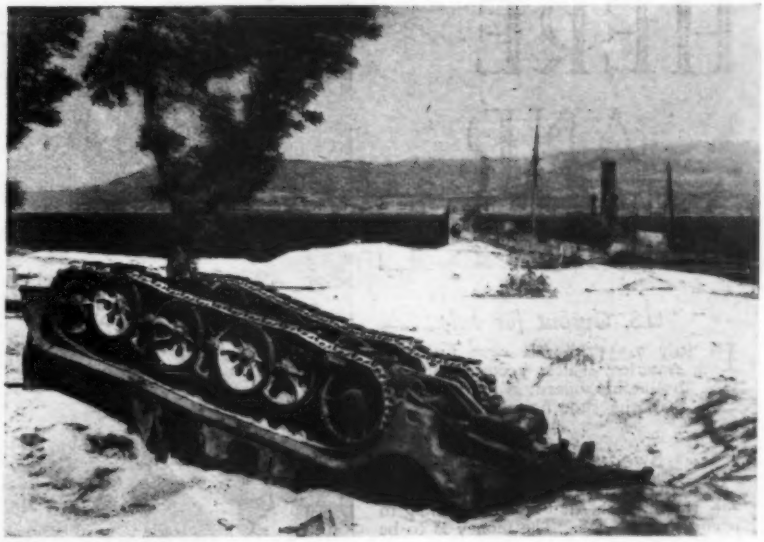
None the less, in case the Germans should, after all, decide to make a stand, heavy bombers undertook a methodical destruction of all the railways which lead southwards from the Brenner Pass. The Naples area was also raided again.

No fewer than six British battleships have been named as taking part in the bombardment of the coast defences, namely, H.M.S. *King George V, Howe, Nelson, Rodney, Valiant* and *Warspite*, besides many cruisers and destroyers, so that if the *Littorio*, the *Vittorio Veneto*, and their new consort decide to come out they will find us ready for them.

BRITISH & U.S. AIR LOSSES to SEPT. 4th

	Over G.B. A'crft.	Continent B'brs.	Continent F'trs.	Middle East A'crft.	N.W. Africa A'crft.
Aug. 29	0	0	1	0	3
30	0	29	1	0	15
31	0	49	5	1	2
Sept. 1	0	0	0	0	0
2	0	2	5	1	15
3	0	31	3	6	1
4	0	0	6	1	6
	0	111	21	9	42

Totals : West, 7,509 ; Middle East, about 2,266 ; North West Africa, 1,170.



OVER SHE GOES : A German troop carrying tractor overturned in a bomb crater on the Messina waterfront. The Italian mainland is visible in the background.

Behind the Lines

Service and Industrial News from the Inside of Axis and Enemy-occupied Countries

Magnesite

IT is reported from Zagreb that a new process for the sintering of amorphous magnesite has been locally developed. Said to be a great improvement on methods currently employed in the production of fireproof material, the importance of the new process is particularly stressed in view of the extensive magnesite deposits in Croatia.

Luftwaffe Chief of Staff

TO replace Gen. Hans Jeschonnek, the Chief of the *Luftwaffe's* general staff, whose mysterious death was reported in our last issue, Gen. Guenther Korten has been recalled from the Russian front.

Korten has the doubtful distinction of being a dyed-in-the-wool Nazi, and one of the few Generals to have been associated with the Nazi Party since its earliest days. He took part in the Munich uprising of 1923, and is the bearer of "The Blood Order"—the highest distinction conferred by the Party.

The new Chief of Staff is 45 years of age, is known for his efficiency and ruthlessness, and has served with the *Luftwaffe* since its inception. He was the brains behind the air operations in the Polish, Balkan and Crete campaigns and is said to have organised the raid on Coventry. He served lately as Chief of Air Staff on the Russian front, where his tactics suffered severe setbacks.

Berlin-Templehof

PASSENGERS arriving at Malmo from Berlin after the R.A.F. raid on August 25th, confirm the extensive damage sustained by the Tempelhof airport. According to these reports, the first hit damaged electric installations in such a way as immediately to turn on the lights, making Tempelhof an illuminated target. Fires were still raging next day, and cars proceeding to the airport had to switch on their lights because of thick smoke in the vicinity. Since runways received direct hits, traffic had to be diverted to the Rangsdorf airfield.

Most airport buildings show extensive damage, and a Swedish correspondent reports from Berlin that the administrative offices of Tempelhof have been wiped out.

Air Protection

A SWEDISH report says that the Germans have resumed preparations for building a large new airfield in the Rugge district south of the River Moss. It is possible that because of the cessation of German transit traffic via Sweden the need for increased air cover for convoys between Norway and Denmark is responsible for these activities.

Scheming ?

REPORTS from Berlin indicate that important *Luftwaffe* consultations are now taking place. The Press publishes pictures of the conferences, and of hints that their purpose is to find the most efficient methods in dealing with the mass raids. In place of the much-promised retaliations, pictures are shown of Col. Gen. Bodenschatz, Major Gen. Galland, Inspector General of *Luftwaffe's* fighters, Col. Loerzer and Prof. Speer, the Reich's Minister for Armament.

HERE AND THERE

U.S. Output for July

IN July 7,333 aircraft were produced in America, which, according to the U.S. Production Board, is four per cent. more than the June figure.

Swedish Expansion

ACCORDING to the Stockholm radio, the Swedish Air Force is planning to spend £13,350,000. The money is to be used to organise bomber and torpedo wings, supplement transport organisation with towed cargo gliders and establish a seventh fighter wing.

Enclosures Not Allowed

THE Postmaster General reminds users of the 6d. air letter service to H.M. Forces and the Merchant Navy overseas that the air letter may not be used for sending enclosures of any kind.

Air letters found to contain enclosures are not forwarded by air; they are sent by ordinary surface transport.

Two Days to Africa

THE chairman of British Overseas Airways Corporation, Viscount Knollys, said at Durban recently that when all facilities are available at each end, it should be possible to do the air journey between Britain and South Africa in 48 hours with the transport aircraft now being designed.

M.A.P. to U.S.A.

MR. BEN SMITH, Parliamentary Secretary to the Ministry of Aircraft Production, and Sir Archibald Rowlands, Permanent Secretary to the Ministry, are visiting the United States and Canada to inspect a number of aircraft factories.

Precision Bombing

EXPRESSING his amazement at the photographic evidence of the destruction wrought by the precision bombing of enemy targets in Europe by Flying Fortresses, Will Rogers, Junr., a member of the U.S. House of Representatives Foreign Affairs Committee, while on an unofficial visit to Britain, said he was not so sure that the war could not virtually be won by bombing.

"The people have been discounting claims of accuracy far too much in the belief that tonnage of bombs is all-important," he said. "Actually our men have been hitting vital targets and putting them out of business. That type of bombing does not require great loads of bombs."

SEEING THEIR WAY CLEAR: On arrival in this country Flying Fortresses have British Indestructo glass fitted to their Sperry ball-turrets. Technical Serg. H. R. Wright, U.S.A.A.F., and Mr. J. Robson, who is employed in making this glass, admire the gunner's "optical flat."

More Test Pilots

THE R.A.F. has agreed to release a number of pilots from operational duties so that they can become test pilots. A school has been established for the training of these men and experienced test pilots will give an intensive course in testing methods.

This remedy has been necessary since the output of British aircraft is so great that there is a shortage of test pilots.

Some Slide!

AN American Flying Fortress pilot, it is reported, recently "belly-landed" his aircraft at nearly 200 m.p.h. without injury to himself or any of his crew.

He was circling the home airfield, on his return from a daylight raid on Schweinfurt, with undercarriage jammed up and one engine dead, when a second engine snuffed out. At 500 feet he conked out of petrol (sorry, "ran out of gas") in such a position in relation to the airfield that to get in at all he had to stuff the nose down quickly and dive for it.

Phew!

Supervisors' Discussion Groups

THE newly formed North London Supervisors' Discussion Group is to hold its first meeting of the coming autumn-winter session at the Enfield Technical College, Ponders End, Enfield, on Monday, September 13th, when Mr. E. F. L. Brech, B.A., B.Sc. (Econ.), A.M.I.I.A., will give a talk on "Personnel Management and its Foundation —the Supervisor."

Then, on Tuesday, September 21st, the N.E. London group will hold its first meeting of the season at the South-West Essex Technical College, Walthamstow, the speaker being Dr. Plummer, M.Sc.(Econ.), B.A., B.Litt., LL.D., who is head of the college's commerce department. Dr. Plummer's talk will be on "Continued Education," which should be of particular interest at the present time.

Discussions will follow these talks, both of which are timed for 7 p.m. Tea will be obtainable at the colleges at 6.30 p.m., and in the case of the new North London group enrolment will follow the discussion.

Change of Name

BEN TRANSPORT, LTD., announce that as this name implies a transport organisation and has, in consequence, caused a certain amount of confusion, it has now been changed to that of B.T.L. Products, Ltd.

No change in the constitution or directorate of the company is involved.

"Flight" Pictures

IT has been found necessary to make a small increase in the price of *Flight* photographs of Allied and enemy aircraft.

In future they will be 8d. each, or 7½d. each when a dozen or more are ordered. The photographs remain the same size, namely, postcard size, and the price includes postage as before.

Prompt Action in U.S.

FOLLOWING a glider crash which killed ten persons in the United States recently, the War Department discovered that a faulty strut was the cause of the accident. Two Air Force inspectors have been suspended and 100 gliders have been grounded at St. Louis as it is possible these craft might contain fittings from the same manufacturing plants.

America Plans Ahead

PERMISSION to establish new air routes has been sought from the Civil Aeronautics Board in Washington by American Airlines and the North-West Airlines Co. The former company are planning to operate a transoceanic service between the United States and Britain, linking New York, Boston, Detroit, Chicago and London.

North-West Airlines are proposing to operate a direct air route to Tokio via Alaska and the Aleutian Islands, and then would extend from Tokio to Shanghai and the Phillippine Islands. The route would not pass over either Canadian or Russian territory.

GRAVEYARD : Messerschmitt 109s and 110s left derelict on one of the captured airfields.

The Tunisian "Aero Show"

Part II of a Review of the Features of Axis Aircraft Types Captured in the North African Campaign

IN "FLIGHT" of September 2nd, our contributor dealt with Axis transport types and gliders which fell into our hands during the North African battles. In this article he continues his description of the machines found, describing the latest fighters, fighter-bombers, bombers and dive-bombers used by the Italians and Germans.

IT is literally true to say that certain areas of the Tunis district were littered with the carcasses of Me 109F and G fighters and fighter-bombers. These types had been used very extensively, not only in an effort to combat Allied fighter action at all altitudes from sea-level to 30,000-odd ft., but for attacking ground targets from very low levels with cannon and machine-gun fire, and with bombs of various sizes, from the 2 kg. anti-personnel to the thin-cased 50 and 250 kg.

The newest version of the Me 109, which was strongly represented, was the G-6. This is the most heavily armed of the Me 109 series. It is powered with the DB 605 A-1 engine of 1,350 h.p. at 18,500ft. The modifications to the armament have obviously detracted from performance. The two synchronised guns over the engine (originally 7.9 mm. MG 17s) have been replaced by MG 13s or 13 mm (½in.) bore, the increased bulk of which has necessitated the fitting of prominent bulges on the engine cowling. These, together with the fairings on the top surface of the wing to accommodate the larger wheels (necessitated by the increase of all-up weight), must reduce substantially the 390 m.p.h. at 22,000ft. attained at full throttle by the cleaner "Gs." Speed is further affected when the optional outboard guns (2 × 20 mm. MG 151/20s) are carried on their faired mountings beneath the wing, and when the carriers for 96 × 2 kg., 4 × 50 kg., or 1 × 250 kg. bombs are fitted. Nevertheless, this fast single-seater, with three 20 mm. and two 13 mm. guns in addition to a 500 lb bomb load, is an Army-support weapon to reckon with A few special Me 109Gs were used for photographic reconnaissance. For this purpose a camera was fitted in the fuselage behind the cockpit.

No additional armour-plate was fitted in ground-strafing Me 109Gs, but the pilot's 8 mm. head armour and 5-8 mm. back protection were installed, in addition to the laminated duralumin plate bulkhead of 20 mm. behind the fuel tank.

In the later stages of the North African campaign, the Germans used the Fw 190 very extensively for ground-attack and army-co-operation work, and some interesting developments associated with the tactical employment of this aircraft were noted. For example, on one, examined near La Sebala, there was new armour-plating designed

The most recent version of the Me 109, known as the G-6. It has a D.B.605 engine, and the fuselage guns have a half-inch bore. The external wing-cannon are 20 mm. M.G.151/20s.

THE TUNISIAN "AERO SHOW"

to protect the petrol tank and pilot against small-arms fire from the ground.

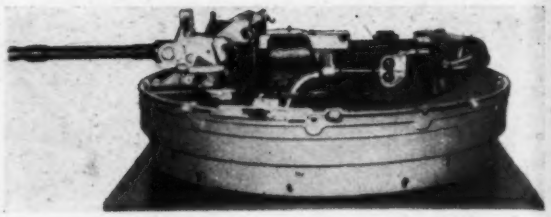
This armour was fitted in addition to the normal protection of 13 mm. head and neck plates, bullet-proof windscreen and armoured rings round the forward end of the engine cowling. The whole of the lower portion of the engine cowling was of 6 mm. armour-plate, hinged on the starboard side just below the air cleaner, and held in place on the port side by quick-release fittings. Behind this were plates screwed to the lower surface of the fuselage and stretching back to a point about two feet behind the trailing-edge of the wing. This plating was also of 6 mm.

The ground-strafing Fw 190 fighter-bombers did not normally carry the 2 x MG 17 fuselage guns, nor the 2 x 20 mm. Oerliken FF outer wing guns, but the MG 151/20 guns in the wing roots were retained in all cases.

In addition to a 250 kg. bomb under the fuselage, it is possible on some sub-types to carry 2 x 50 kg. or 1 x 250 kg. bomb under each wing as an alternative to jettisonable petrol tanks.

New Messerschmitt 110

One was a particularly interesting example of the Me 110. It was of the new G series, which, in effect, bears the same relationship to the earlier 110s as does the 109 G the older "Es" and "Fs." It is fitted with DB 605 B-1 engines (similar to the power plant of the 109 G except for the reduction gear ratio). In place of the two Oerlikon FF 20 mm. guns in the bottom of the fuselage, firing out through the nose, it has two MG 151/20s, which, of course, increase the fire power appreciably. The four 7.9 mm. MG 17s in the nose are retained, but the original



A German 13 mm. M.G. 131 machine gun in an electrica ly operated turret.

MG 15 free gun in the dorsal position has been displaced by twin MG 81s; thus defensive fire power is also improved. The aircraft is quite heavily armoured, and behind each spinner is a 5 mm. plate of the same diameter as the spinner.

Me 110s of this series, perhaps with even heavier armament, are employed as night fighters in Germany.

For ground-attack work 500 kg. of bombs can easily be handled on this type, and the potential bomb load is considerably greater.

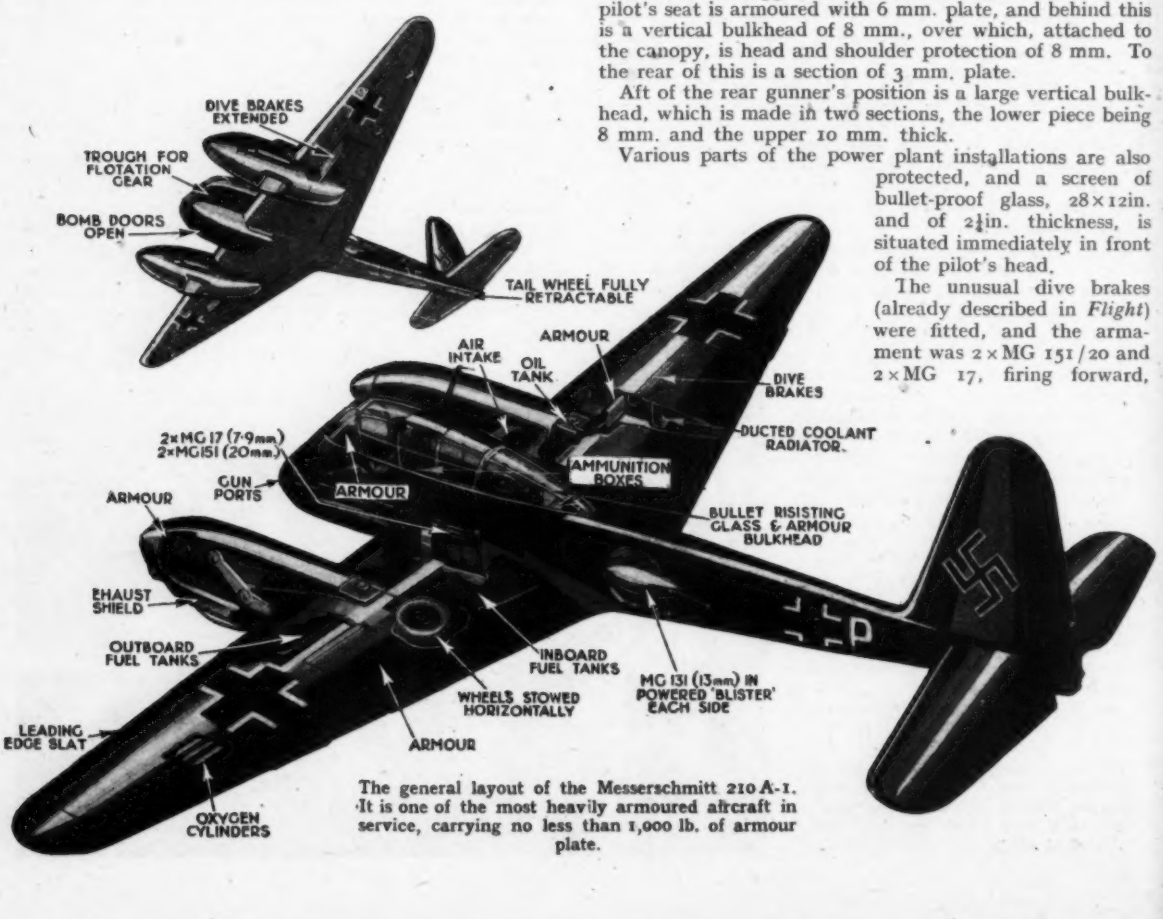
Thus it appears that this well-tried multi-purpose aircraft is taking on a new lease of life, but it seems certain that the Germans will not again employ it in the role of an escort fighter as during the Battle of Britain.

At Karouba/Bizerte was a Me 210 A-1 which was essentially similar to the aircraft of this type examined in this country. The armour protection is exceptionally heavy, and weighs well over 1,000 lb. Inside the skin of the fuselage, and conforming to the shape of the nose, are two curved pieces of plate. These overlap the main frontal armour, which is made of two pieces bolted together. The lower section of this frontal armour is 12 mm. thick, and the upper section 6 mm. The bottom of the pilot's seat is armoured with 6 mm. plate, and behind this is a vertical bulkhead of 8 mm., over which, attached to the canopy, is head and shoulder protection of 8 mm. To the rear of this is a section of 3 mm. plate.

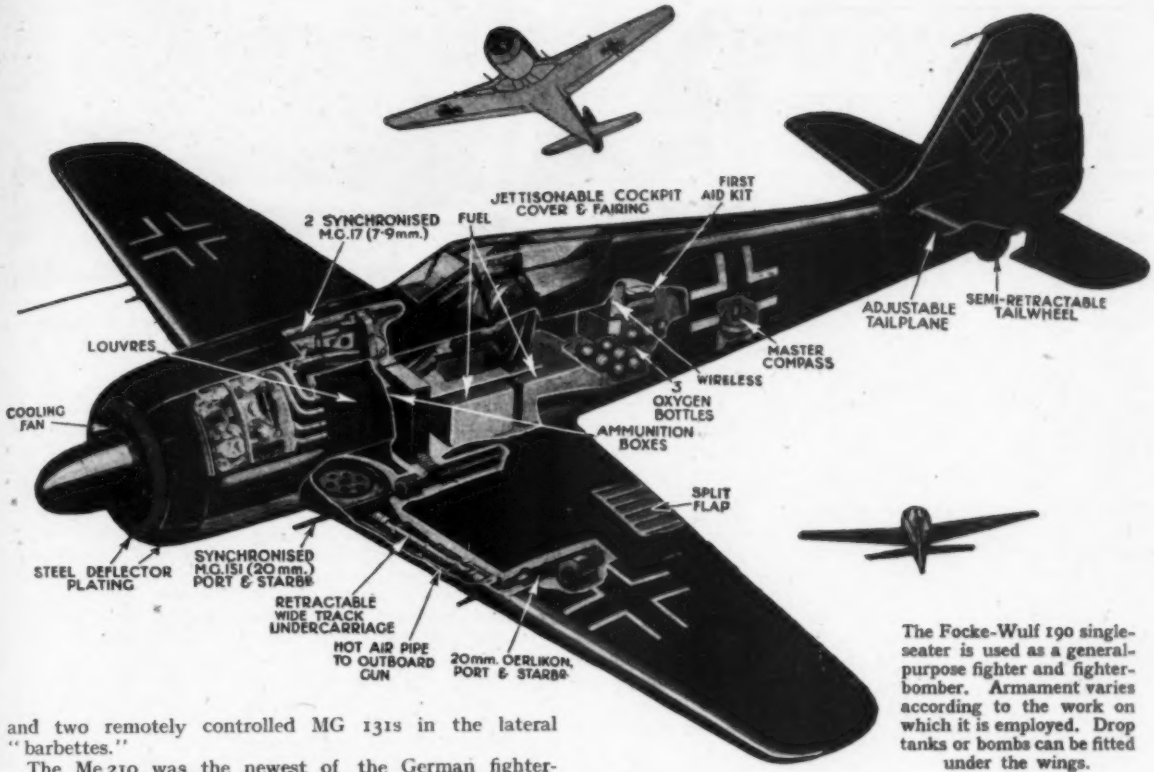
Aft of the rear gunner's position is a large vertical bulkhead, which is made in two sections, the lower piece being 8 mm. and the upper 10 mm. thick.

Various parts of the power plant installations are also protected, and a screen of bullet-proof glass, 28×12in. and of 2¼in. thickness, is situated immediately in front of the pilot's head.

The unusual dive brakes (already described in *Flight*) were fitted, and the armament was 2×MG 151/20 and 2×MG 17, firing forward,



The general layout of the Messerschmitt 210 A-1. It is one of the most heavily armoured aircraft in service, carrying no less than 1,000 lb. of armour plate.



The Focke-Wulf 190 single-seater is used as a general-purpose fighter and fighter-bomber. Armament varies according to the work on which it is employed. Drop tanks or bombs can be fitted under the wings.

and two remotely controlled MG 131s in the lateral "barbettes."

The Me 210 was the newest of the German fighter-bombers represented. A fighter Ju 88 was also used to a limited extent and will be referred to later.

The Italians employed the Fiat G.50 and the M.C. 200 very extensively for ground strafing, and there were numerous examples of the latter type in the Tunis area. The armament of 2 × 12.7 mm Breda-Safat guns is retained, and two 50 kg. bombs can be carried under the wing on faired racks.

The best of the Italian fighters available in quantity was the M.C. 202, fitted in many cases with the Italian-built version of the German DB 601 engine. The 202 is a truly modern fighter in all respects, except possibly in armament, but even this is heavier than on the M.C.200, consisting of two 12.7 mm. and two 7.7 mm. guns. In all cases the tanks were of the self-sealing type, and armour protection and wireless were fitted.

A development of the M.C.202, designated M.C.205, was also introduced towards the end of the Tunisian campaign. This is generally similar to the 202, but is fitted with the DB 605 engine.

The Reggiane Re 2001 was not nearly so extensively employed as the M.C.202. This fighter has the same engine and armament as the 202, but probably a slightly lower performance, though it has the advantage of a longer range. Fitted with the DB 605 engine, the Re 2001 becomes the Re 2005.

Bombers

The ubiquitous Ju 88 was discovered amongst the wrecks in various guises: bomber, reconnaissance aircraft and fighter. The bombers were usually of the "tropicalised" A-4 type with two Jumo 211 J engines fitted with induction air coolers. This variety of Ju 88 is already well known, but the "D" series, which is generally similar but is equipped for reconnaissance work, s not so familiar. The Ju 88 D carries three cameras and an elaborate camera-heating installation. Normally bombing equipment is not fitted on reconnaissance flights, but this can be installed in an emergency.

An interesting accessory for use on the Ju 88 was a gun container known as the "WB 81." This resembled a jettisonable tank, and is intended to be suspended from a wing bomb-carrier of the Ju 88, which could carry two. The WB 81 houses three twin MG 81 guns which are fixed to fire downwards at an angle of 15 deg., thereby greatly increasing the fire power for ground strafing.

At Bizerte was a Ju 88 C-6 fighter, known to the Germans as a "heavy fighter." This model is also fitted with Jumo 211 J engines, but has a built-in fixed, forward-firing armament of 3 × MG 17 and 1 × MG FF (20 mm.). The usual rearward-firing free ventral armament may be omitted, and in its place two fixed, forward-firing 20 mm. FF guns may be installed. The normal crew is three, and special armour plating, suitable for a fighter, is fitted. This includes a circular bulkhead 11 mm. thick in the nose of the fuselage.

There was little of interest on the few He 111 bombers seen. They were of the "H" series, fitted with Jumo 211 F engines (this is similar to the 211 J except that no induction air cooler is fitted), and in some cases with the new dorsal armament consisting of an MG 131 13 mm. gun.

The Italians made a poor showing in operations with their SM 79 and SM 84 torpedo-bombers. No greater success was met by the Cant. Z 1007 bis bomber; and the four-engined Piaggio P.108, of which only very small numbers were available, put in only a few, but always undistin-

The Mauser 151/20 cannon. Rate of fire is over 700 rounds per minute. It is produced in 15 mm. and 20 mm. models.

TUNISIAN "AERO SHOW"

guished appearances. Although the SM 84 represents a comparatively small advance over the SM 79, despite its cleaner aero-dynamic design and more powerful engines, it was nevertheless the most modern Italian bomber used, and accordingly a brief description may be of interest.

Perhaps the most noteworthy feature was the armament, which comprised four guns of the Isotta-Fraschini "Scotti" 12.7 mm. type; these were disposed one each in the port and starboard lateral positions (firing through large windows); one in the ventral position, and one in a Caproni hand-operated dorsal turret similar to that fitted on the Cant Z.1007 bis. This last gun, incidentally, is electrically fired through a solenoid operated from the control wheel. The arcs of fire are 360 deg. in azimuth, 80 deg. in elevation, and 10 deg. in depression. For sighting there is an internal bead and external ring, the bead having an automatic "own-speed" correction. A guide rail prevents the gunner shooting into the airscrews or tail.

It is by now well known that the SM 84 can carry two torpedoes, each of over 800 kg. (1,764 lb.). Alternative bomb loads are 10×100 kg. bombs internally and four under each wing; 3×250 kg. bombs internally and two under each wing; or 2×500 kg. internally and one under each wing. The bomb-aimer's compartment is below, and slightly forward of, the pilot.

The armour protection of the SM 84 was more comprehensive than found on Italian bombers during the campaign last year.

Dive-bombers and Ground-attack Aircraft

The only specialised single-engine dive-bomber used during the Tunisian campaign was the Ju 87 D. This has the usual two fixed M.G. 17s in the wing and a very neat installation of twin belt-fed M.G. 81 in the dorsal position. About 300 lb. of armour plate was carried, but on no occasion was there any evidence of Ju 87s having carried their maximum bomb load which, under ideal conditions, is about 1,800 kg. (3,968 lb.). The Jumo 211 J engine of 1,300 h.p. at 12,500ft. was the standard power unit of the Ju 87 D.

A Macchi 202 shot down in North Africa. This has a Daimler-Benz 601 engine, but later types have the D.B. 605 1,350 h.p. engine. With the D.B. 605 it is known as the Macchi 205.

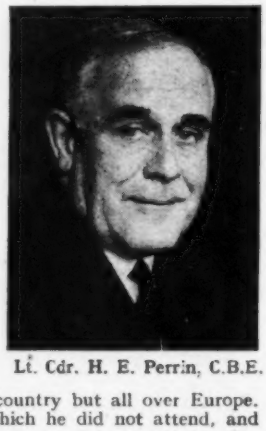
Although it seems to be one of the less successful German aircraft introduced during this war, the Hs 129 ground-attack aircraft was none the less interesting from the technical aspect. The Hs 129 B, fitted with two French-built Gnome-Rhône 14 M 14-cylinder radials, each of 800 h.p. at 8,000ft., was the version used in Tunisia. The standard fixed armament was 2×M.G. 17 and 2×M.G. 151, although a 30 mm. MK 101 "tank-busting" gun could be fitted under the fuselage in place of a portion of the bomb load. Typical bomb loads on the Hs 129 B are: 4×50 kg.+48×2 kg.; or 6×50 kg. The armour protection weighs over 1,000 lb., which, of course, is a remarkably high figure for such a small aircraft.

It is not surprising that the Fw 190 and Mc 109 were more popular for low-level attacks than the specially designed Hs 129 (a photograph of the Hs 129 was published on p. 247 of last week's issue). Like certain other types introduced by the Germans in recent months, this Henschel is a disappointment; it was outclassed from the start by the Hurricane IID with its two high-velocity 40 mm. guns. But the quality of future *Luftwaffe* equipment must not be assessed from the showing made by this type, and some formidable new machines may yet be found abandoned after Axis defeats and retreats of the future.

HAROLD PERRIN TO RETIRE

THE British aviation world, and indeed flying circles all the world over, will learn with some surprise that Lt. Cdr. H. E. Perrin, C.B.E., has expressed a wish to retire after the war from his post as secretary of the Royal Aero Club.

Harold Perrin is one of the very few still associated with the R.Ae.C. who helped in the formation of the Aero Club before it rose to the dignity of the Royal prefix. That was 42 years ago when flying was confined to ballooning. The club then occupied a single room in Piccadilly, next to the present premises. Reference to those early days conjures up memories of the early struggles of Englishmen to fly. Names come to mind such as Charles S. Rolls and A. V. Roe. Others associated with the earliest days of the club were Hedges Butler, Griffith Brewer and Stanley Spooner, late owner and Editor-in-Chief of *Flight*. When this journal was founded as a separate publication in 1909 it became the official organ of the club, and our association has been very close ever since.



Lt. Cdr. H. E. Perrin, C.B.E.

Harold Perrin is, or was until the present war put an end to international sporting flying, a familiar figure not only in this country but all over Europe. Few were the flying meetings which he did not attend, and as secretary of the Royal Aero Club it fell to him to represent, usually with Col. Mervyn O'Gorman, the R.Ae.C. at the meetings of the F.A.I. in Paris and elsewhere. Through the International Aeronautic Federation the R.Ae.C. was able to influence in many ways and directions the regulations governing sporting flying, air touring, etc., and the good fellowship established did much to improve international relations, although it was not powerful enough to prevent the war.

The Committee of the Royal Aero Club has felt that not only members of the club but all those who are interested in the development of aviation will wish to mark their appreciation of Harold Perrin's work, and it has been decided to raise a testimonial to him. A letter informing members of the club and others of this decision has been sent out, signed by the president of the club, Lord Brabazon of Tara; by Sir Francis McClean, the club's chairman; by the chairman of the Private Flying Committee, Sir Lindsay Everard, M.P.; and by the chairman of the Finance Committee, Sir Frederick Handley Page.

Those wishing to contribute donations should address them to the Chairman of the Royal Aero Club, 119, Piccadilly, London, W.1. Cheques should be made payable "Royal Aero Club Testimonial."

Gas Turbines and Jet Propulsion for Aircraft
By G. GEOFFREY SMITH, M.B.E.
A second edition of the above booklet is now available from "Flight" publishing offices. The new work consists of ten chapters and includes many illustrations. Price 3/6 plus 3d. post.

Tactical Bombing

Lessons from Sicily

By MAJOR F. A. de V. ROBERTSON, V.D.

EVER since the days of Sir William Russell (as he afterwards became) and his despatches from the Crimea, the war correspondents of *The Times* have held a high reputation for presenting fair and judicial pictures of the campaigns which they have described. The public has learnt to expect from them not merely graphic stories of gallant feats of arms, but also a critical summing up of the conduct of the operations and of the lessons taught. The basic principles of stategy and tactics are eternal, but, nevertheless, no two wars are exactly the same. New weapons introduce novel methods of applying tactics, and often it is only by trial and error that the best methods of application are discovered.

In the course of a war Generals cannot be expected to publish and comment on mistakes made by themselves or their subordinate officers, and even a Minister of Defence is likewise tongue-tied to a great extent. He may dismiss one commander and appoint another, but he cannot well make his reasons public. Likewise, successful experiments have for the most part to be passed over in silence until the war is over. For a partial revelation of what has really happened the public can only look to war correspondents of the highest class.

Two New Weapons

From the point of view of academic military study the present world war is especially interesting because two novel weapons are being tried out for the first time. They are the aircraft and the tank. Both were used with effect in the first world war, but it is now realised that both were then in an embryonic state. Now they have attained their majority, though of course each is capable of much future development.

During the present war each has had its periods of success and its periods of comparative ineffectiveness. The less successful periods have sometimes been due to material causes, such as shortage of supply or the absence of the right type for the particular job in hand, and sometimes they have been due to incorrect tactical handling. The war correspondent who is able to put his finger on the cause for the success or failure of either weapon in each campaign does a notable service to all students of war.

The Sicilian campaign has just been brought to a close, and the correspondent of *The Times* who accompanied General Alexander's Army Group in the island has duly sent to his paper his reflections on what happened and why it happened. His three articles are most interesting and give much food for thought.

No Dive Bombers

The whole campaign of 38 days was so successful that the general impression in many quarters was that all had gone as merrily as a wedding bell. This correspondent pointed out that some mistakes were made, and that some experiments were not successful. Tanks played no major part in the campaign, and in any case armoured fighting vehicles are not a concern of an aeronautical paper, except when they work in conjunction with aircraft. But the latter were very prominent, at least on the Allied side.

The *Luftwaffe* hardly appeared, and so General Alexander's men were not harassed by dive-bombers. This correspondent has some remarks to make about dive-bombing, nevertheless. He says: "There never was a good infantryman yet who did not begin by dreading it and end by treating it as a showy but overrated form of attack." That tallies with reports by our soldiers in Norway and with General Sir Thomas Blamey's Order of the Day to his Australians at the end of the campaign in Greece.

Of our use of airborne troops the writer has less comforting things to say: "We also tried several airborne landings, both of parachutists and of gliders, but with these we had only partial success. They disclosed weaknesses which cannot be discussed here, but which are being carefully studied." We must leave it at that.

No comment is made in the article on the degree of help given to our assaulting infantry by the Tactical Air Force. No doubt that was because it is accepted that in mountain warfare aircraft are less effective than they are on a flat terrain. A tendency of the infantry to "send for" the light bombers or fighter-bombers is noted, but so far as has been reported the storming of the critical hill fortress of Centuripe was carried out by the infantry of the 78th Division without any, or at any rate much, help from the air. One remembers that in East Africa the South African light bombers acted as field artillery in support of the Indians who stormed Keren, and that in Tunisia the Tactical Air Force played a great part in conjunction with the artillery in blasting a path for the infantry. Keren, however, was held by Italians, not Germans, and Tunisian conditions were not identical with those of Sicily. On that island the roads provided the chief targets for our light aircraft.

Another point, which had been reported before, is emphasised in these articles. The escape of numbers of boats across the Straits of Messina was covered by *flak*, not by German fighters. Probably no fighters were available, but the success of the *flak* is rather astonishing, even for daylight operations.

The Dominating Lesson

But the most striking conclusion arrived at by the correspondent of *The Times* is as follows: "The dominating lesson of the Sicilian operations was that the bombers, particularly the Fortresses, can blot out an entire enemy air force before the landing is made." That happened in Sicily, but are we to accept it as a principle that tactical bombing can always be relied on to produce that effect? The correspondent seems to think so, for he says with great emphasis that the success of the tactical bombing provided "the dominating lesson."

The history of other campaigns in this war offers conflicting evidence. Those in Poland and Norway may be disregarded because the opposition to the *Luftwaffe* was not strong enough to provide evidence for or against the correspondent's theory. In the Battle of Britain, though a few British airfields were temporarily put out of action, Fighter Command was certainly not "blotted out." The fighters on Malta had their airfields constantly riddled with craters and were always heavily outnumbered; yet they contrived to maintain a victorious defence against the worst that the *Luftwaffe* could do. Before the British advance at Alamein the German air arm was reduced to ineffectiveness largely because its airfields were flooded while those of the R.A.F. were not, and partly because a number of Rommel's tanker vessels were sunk. That case does not teach a lesson of universal application.

The recent attack on Foggia provides evidence which tends to contradict the theory of the correspondent of *The Times*. Attempts were made by waves of low-flying Lightnings to paralyse the chain of airfields round Foggia, but when Fortresses came over half an hour later they were attacked by from 60 to 100 fighters which had escaped the attentions of the Lightnings.

Sicily had only 25 airfields, not an extravagant number, and the success with which they were all rendered ineffective suggests that fortune as well as good organisation favoured the Allies. We must hesitate before we can accept it as a general principle that tactical bombing, even if severely applied, can always paralyse air defence.

Sixty-fifth of the Latest Recognition Series

Aircraft Types and

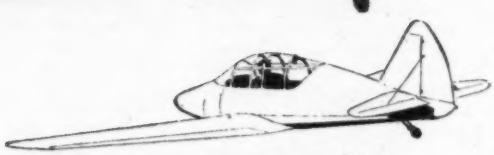
PIPER PT TRAINER

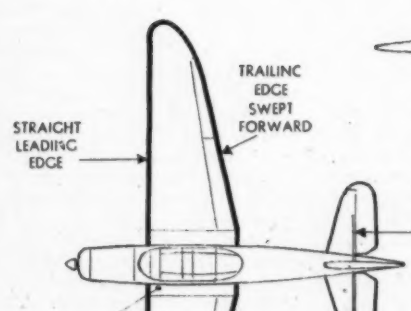
HITHERTO the Piper concern has always specialised in high-wing monoplanes, and their representative in the "grasshopper" class of liaison aircraft for the U.S. Army Air Force was typical of this type. Now, however, comes the first low-wing Piper—the PT trainer.

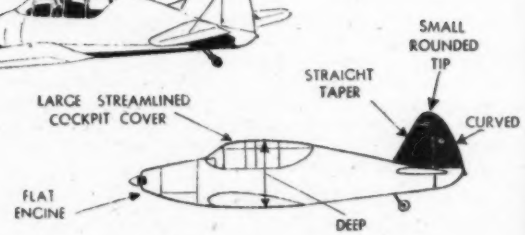
As will be seen from the photograph and drawings of the prototype, the new Piper is an extremely clean job, and it is claimed that its flying characteristics make it equally suitable for primary training or more advanced instruction.

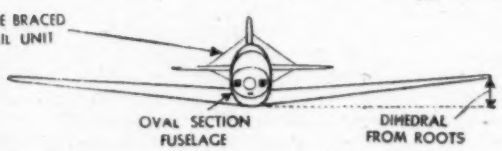
Powered by a 130 h.p. Franklin "flat six" air-cooled engine, the PT is credited with a top speed of 150 m.p.h. plus, a cruising speed of 135 m.p.h. plus, and a landing speed of 50 m.p.h. minus A more powerful engine can, however, be fitted without any structural changes. Mixed construction is employed, the oval section fuselage being built up of steel tubes with wooden stringers, and with the exception of plywood decking, is fabric covered aft of the front cockpit. Incidentally, the engine is readily accessible by large doors hinged near the top centre and extending two-thirds down the sides of the cowl—very much like the bonnet of a motor car, in fact.

The wings, built in the usual three sections, are box-type monospar design with wooden ribs, and are covered with mahogany diagonal plywood over which is laid a fabric skin. An auxiliary rear spar carries the ailerons and slotted flaps. Two stainless steel fuel tanks, whose total capacity of 40 U.S. gallons gives a cruising range of 700 miles, are housed in the centre section, which also accommodates the inwardly retracting undercarriage. This latter, by the way, is hand operated on the prototype, but it is intended to be electrically operated on the production models. Fin and tailplane are plywood and fabric covered, but all control surfaces are fabric covered only. Both cockpits contain a full set of controls, and auxiliary panels for blind-flying instruction, plus radio operated from either cockpit, can be added.







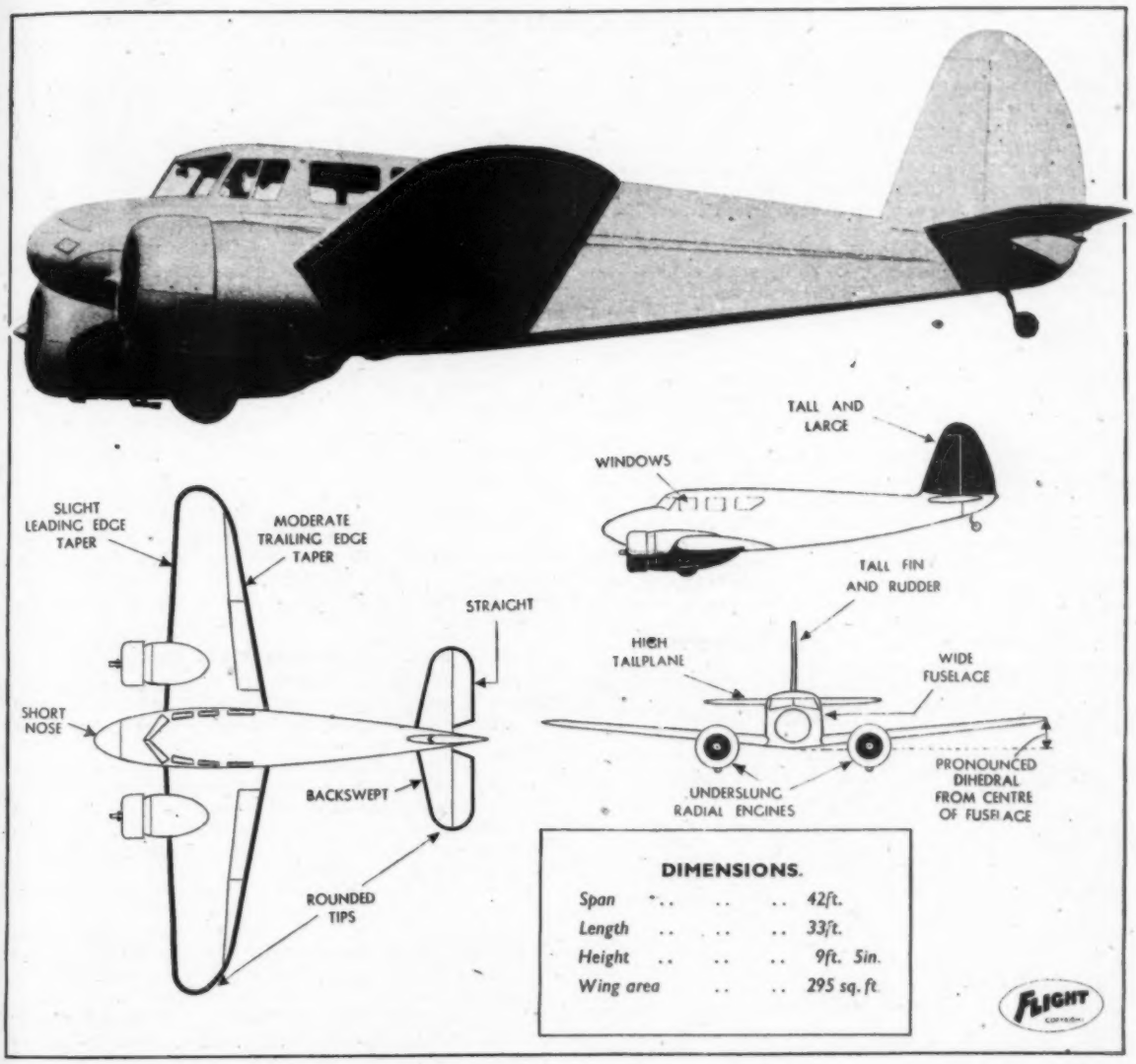


DIMENSIONS.

Span	*34ft.*
Length	*22ft. 10in.*
Height	*6ft. 6in.*
Wing area	*164 sq. ft.*

nd Their Characteristics

CESSNA CRANE



GIVING excellent service with the R.C.A.F., the Cessna Crane is known in the U.S. Army Air Force as the Bobcat with the training designation AT-17, or, when allocated to "personnel transport" duties, as the C-78. To its manufacturers, all versions (which differ only in the matter of equipment) are known as the Cessna T-50.

Notable for its adequate performance and general adaptability, the Cessna Crane can also be equipped as an ambulance with two stretchers, or for photographic work with two automatic cameras, but it is as an advanced trainer that it is most widely used by the R.C.A.F.

Earlier models of the Crane were fitted with two 225 h.p. Lycoming R-680 seven-cylinder air-cooled radial engines, and this model was the AT-8 in the U.S.A.A.F. The current version, however, has a pair of Jacobs L-4MB engines which are of the same size and rated horse-power, and these give it a top speed of 195 h.p. at sea-level and a cruising speed of 175 m.p.h., also at sea-level. At 7,500ft., however, the Crane can cruise at 191 m.p.h. It has a service ceiling of 22,000ft., a range of 750 miles and will land, with flaps, at 55 m.p.h.

It provides not only multi-engine training for pilots, with firing practice from fixed machine-guns in the nose, but air-gunners can also be trained, there being provision for the fitting of a dorsal turret with a single gun, or a single flexibly mounted machine-gun firing through a ventral hatch.

Mixed construction is employed, the roomy, well-streamlined fuselage being a fabric-covered structure of welded steel tubes, while the one-piece wings are built up of laminated spruce spars and spruce ribs. The leading-edge and wing tips are plywood-covered, but the rest is fabric-covered. Tailplane and fin are of wood, but the rudder and elevators have welded steel tube frames, the whole tail-unit being fabric-covered.

In its C-78 version, the Crane accommodates five persons.

Reversible-pitch Airscrews

Their Effectiveness as Air Brakes, Landing Brakes and Dive Brakes : "Power-on" and "Power-off" Distinctions

By J. MULLIN*

IN recent weeks the correspondence columns of *Flight* have included a series of letters discussing the possibilities of using reversible-pitch airscrews as airbrakes and landing brakes for aircraft. Since there appears to be very little agreement on the manner in which a braking airscrew functions, and even doubt as to the feasibility of this development (which will undoubtedly be of widespread future application), I should like to attempt a simple explanation of this subject.

First, I should like to dispel any doubts as to the practicability of using the airscrew both as an airbrake, to limit the speed of an aircraft in a dive or under other conditions, and as a landing brake, to reduce the landing run of heavily loaded machines.

As far back as September, 1932, a programme of flight tests was carried out by the National Advisory Committee for Aeronautics, the well-known American research institution, in which a series of terminal velocity dives were made with the airscrew set at very small blade angles and allowed to windmill against the engine friction. These tests showed that the terminal velocity of a diving aircraft could be very considerably reduced by an air-braking airscrew, and the results have been published in reference 3 of the bibliography attached to these notes.

The success of the airscrew used as a landing brake, with engine power on and the airscrew blades set at a large negative angle, is well described in reference 1, in which the Escher Wyss Company of Switzerland state that tests of a landing-brake airscrew carried out on a fighter aircraft have enabled them to reduce the landing run to 28 per cent. of its value when no brakes of any kind were used. Normal wheel brakes only reduced the run to 61 per cent. of its unbraked value.

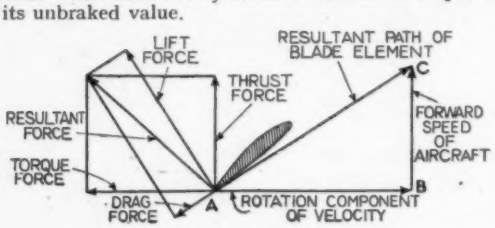


Fig. 1.

A certain amount of data from wind tunnel tests in various countries has been published from time to time, giving the characteristics of airscrews when operating at small positive and at negative blade angles, as they would be during a braking operation. These references are also included in the attached bibliography.

Besides their uses as airbrakes and landing brakes, reversible-pitch airscrews are proving extremely useful for manœuvring large flying boats on the water. In this case, as in the landing brake case, the negative thrust is obtained by turning the blades into negative pitch and using the engine power to drive the airscrew round. Various American flying boats have already made use of this feature of the Curtiss electric airscrew.

At this point it seems convenient to make the distinction between "power-on" and "power-off" or "windmilling" conditions of braking.

The power-on condition is that used for braking during landing and in flight at low airspeeds, when the airscrew blades are rotated to a large negative angle and the engine power applied.

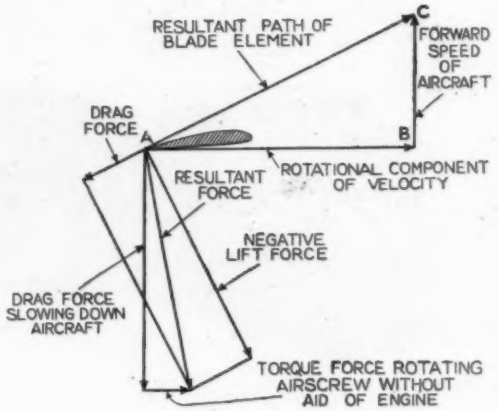


Fig. 2.

For braking at high airspeeds there is not much increase in braking effect to be gained by using the power-on condition compared with the large drag forces that can be obtained by putting the blades into approximately zero pitch and allowing the airscrew to windmill against the friction of the engine with throttle closed.

Action of Aerodynamic Forces

Finally, in order to complete this discussion, I should like to give a brief, simple explanation of the aerodynamic forces acting on the airscrew blades during a braking operation.

It is usually convenient to consider the performance of an airscrew as a whole to be represented by the performance of the section at about three-quarters of the tip radius of the blade, and in this particular problem this will be the simplest way of reaching a clearer understanding of the operation of the airscrew.

First of all, consider an airscrew operating in the normal way at a positive blade angle and a small positive angle of incidence. In Fig. 1 the three-quarter radius section of the blade is travelling sideways along AB due to the rotation of the airscrew, and at the same time is being moved forward along the line BC by the forward motion of the aircraft as a whole. Thus the true path of the blade element through the air is represented by the line AC. In

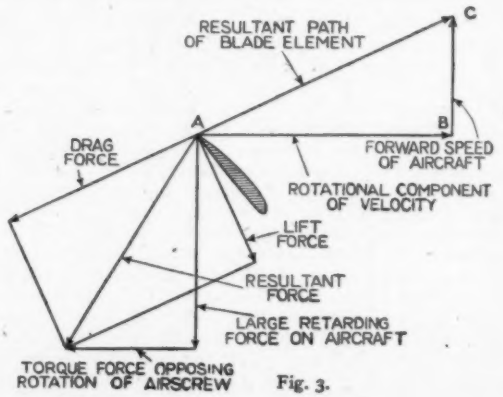


Fig. 3.

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REVERSIBLE-PITCH AIRSCREWS

this position the blade is giving a positive lift and a drag force which combine to produce a resultant torque force, opposing the engine torque, and also a forward thrust force pulling the aeroplane forward through the air.

Now suppose that the blade angle is suddenly reduced till the blade section reaches the position shown in Fig. 2.

The blade is now operating at a negative incidence and thus produces a negative lift force; the drag force, of course, remains in the same direction as before. In this case the combination of lift and drag forces produces a resultant force tending to slow the aircraft down and to keep the airscrew rotating without the help of any engine power. This is the windmilling condition of operation.

If the blades be rotated farther to the position shown in Fig. 3, the power-on condition of braking is attained. In this position the blades are at a very large negative angle of incidence and produce a large drag force and a comparatively small negative lift force, resulting in a large force on the blade, which retards the motion of the aircraft and produces a torque force on the blades opposing their rotation in the usual direction. Thus engine power must be used in this case to keep the airscrew turning.

These notes have now become rather lengthy, but I believe it really is desirable at this stage to clear away the numerous misconceptions which appear to be held on the functioning of negative-pitch airscrews.

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Wings Club

New West End Club for R.A.F. Officers in London

A WEALTHY American in London has made one more contribution to the cause of Anglo-American friendship in the shape of a West End club for younger Royal Air Force officers stationed in London or who are spending their leave in the Metropolis.

This latest solution of the What-shall-I-do-with-my-leave? problem is the Wings Club, 11, Grosvenor Place, S.W.1, almost opposite the Royal Artillery Memorial at Hyde Park Corner.

The premises were formerly the home of Lord Moyne, who has given the house rent-free to the committee. It has been beautifully reappointed and converted into one of the most comfortable, tasteful clubs in London.

Membership is free, and there is an excellent bar, snack bar and restaurant where meals are served: Breakfast, 1s.; lunch, 2s. 6d.; tea, 1s.; dinner, 3s. 6d.

Beds can be reserved for up to nine days, the average leave period, at 5s. a night. There are tennis courts nearby and, in the club, billiards, shower and bathrooms, lounge, library, writing-room, and an efficiently run information bureau.

Everything is being done to welcome young officers, arrange theatre and sports reservations; dances are held twice a week, and various forms of hospitality for members. Women guests may be introduced in the evenings.

The telephone number of the club is Sloane 0681.

(Top, right) A corner of the panelled lounge.

(Above) The library and writing room seen through the open door. The library is open on each morning and afternoon except on Saturdays and Sundays.

(Bottom, right). At the counter in the snack bar.

PHOTOGRAPHIC RECONNAISSANCE

Specially modified for a job that calls for speed, altitude and range, this P.R.U. Spitfire is seen to have a four-bladed airscrew, which implies a Merlin LXI engine with two-speed, two-stage supercharger. This type has photographed bombed Berlin.

Coastal Command's P.R.U. Covers "Quite a Large Parish": Camera Sorties in Spitfires and Mosquitoes : Quick Results by Mechanical Processing

HIGH in the clear sky above a German industrial target, pranged the previous night by Bomber Command, a solitary British aircraft circles, makes a straight run, and then streaks back towards its base in Great Britain. It is so high that its pilot wears an oxygen mask, and it is so fast that, should the enemy below try to do something about it, neither his flak nor his fighters are likely to meet with much success. It may be a Spitfire or a Mosquito, but in either case it belongs to the Photographic Reconnaissance Unit, and within an hour or two the Intelligence officers at its base will know the extent and strategic value of the damage inflicted by the bombers.

Working under the operational control of Coastal Command, the P.R.U. is a branch of the R.A.F. whose importance in the air war may perhaps be described as in inverse ratio to the amount of publicity it has received in the past. This article, written as the result of a visit by *Flight* to one of its home bases, will do something towards giving to this efficient but unpretentious unit at least some of the great amount of credit due to it.

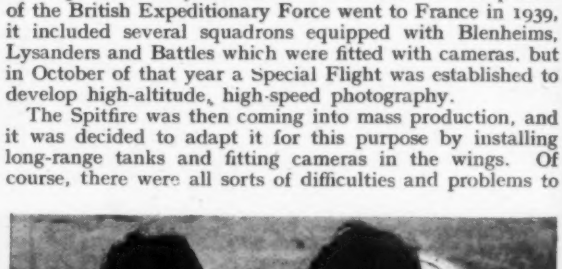
Purely Strategic

In command of this P.R.U. station is Air Comdre J. N. Boothman, of High Speed Flight fame in pre-war days, and he explained to us that their sorties range from the north of Norway to Gibraltar, which, in his own modest words, is "quite a fair parish to serve."

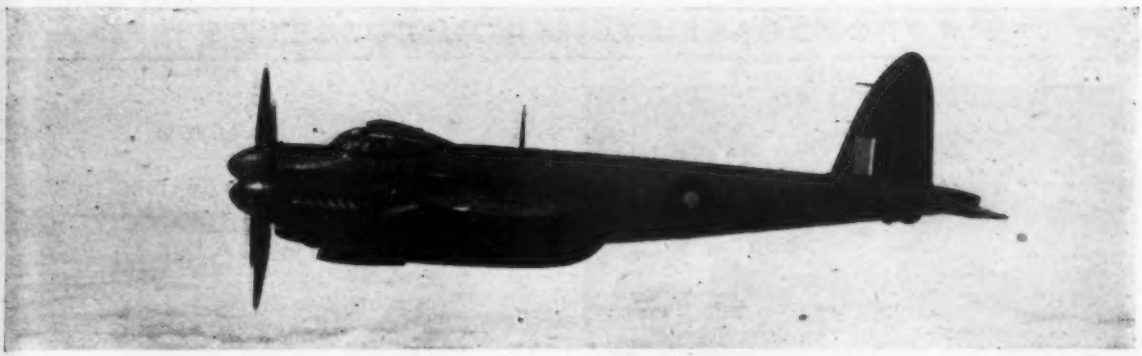
The nature of its photographic reconnaissance is purely strategic and is all long- and medium-distance work. Requests for photographs of targets, whether made by Bomber or Fighter Command, the Navy or the Army, or from, say, the Ministry of Economic Warfare, pass through a central Air Ministry channel which authorises the flight and fixes the priority. A little point that Air Comdre Boothman did not mention, but which was disclosed by one of his enthusiastic pilots, was that he himself often climbs into a "Spit" and goes out on a sortie—you can't keep a Schneider Trophy winner down, despite the fact that his hair is now greying at the temples.

It is perhaps hardly necessary to explain that the P.R.U., as now constituted, did not spring into being overnight. Photographic reconnaissance had admittedly grown to a pretty considerable business even by the end of the last war in 1918, but when the present war broke out in 1939 the requirements had so changed that its organisation had to be undertaken almost afresh. In the last war it had been practically all tactical work for the Army, but now its scope had vastly increased. When the Air Component of the British Expeditionary Force went to France in 1939, it included several squadrons equipped with Blenheims, Lysanders and Battles which were fitted with cameras, but in October of that year a Special Flight was established to develop high-altitude, high-speed photography.

The Spitfire was then coming into mass production, and it was decided to adapt it for this purpose by installing long-range tanks and fitting cameras in the wings. Of course, there were all sorts of difficulties and problems to



PIN POINTERS : High-level map reading is essential in the P.R.U., and this Mosquito crew are checking their course to a distant target.



LUNCH IN RUSSIA TO-DAY? The advent of the Mosquito greatly extended the range of photographic reconnaissance. While its actual range in figures may not be given, it recently enabled one crew to lunch in Russia before returning to its British base. Note the auxiliary "drop tank," one of which is fitted under each wing.

overcome. Pilots working single-handed demanded a new technique, and the cameras then available, designed to operate at 12,000 to 15,000ft., obtained too minute a picture at 25,000 to 30,000ft. Cameras with longer focal length were made, but they brought fresh problems of their own because they could not be fitted in the wings; they had to go into the fuselage behind the pilot. Also there was the little matter of freezing up to be attended to.

However, organisation and development proceeded rapidly, the name of "Special Flight" gave way to that of "No. 2 Camouflage Unit," and on March 2nd, 1940, the whole of the Ruhr was covered in one sortie, the mosaic then obtained having since been of great help to Bomber Command. The range and performance of the Spitfire was being steadily improved, and on April 7th of that year it was possible to send one to Kiel for the first time.

The pictures it brought back showed the departure of German forces for the invasion of Norway but, because we had no previous pictures to provide a basis of comparison, this all-important fact was not realised at the time by those endeavouring to interpret the photographs.

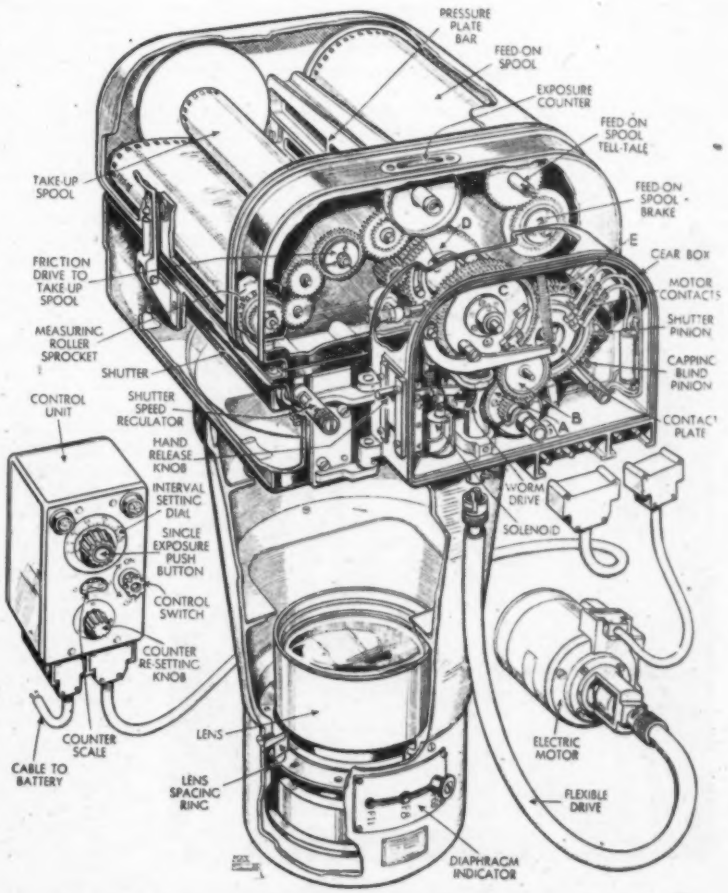
When France Fell

The same month the name of the unit was again changed, this time to Photographic Development Unit, and it had detached flights working in France. With the fall of that country the whole character of the work changed, the unit became known by its present name and was placed under Coastal Command as being the R.A.F.'s reconnaissance command.

At the time of the Battle of Britain and just after, P.R.U. was still a small unit, largely because Fighter Command wanted all the Spitfires it could get, but nevertheless the flying photographers kept the closest check on enemy activities across the Channel.

With the immediate danger of invasion receding, P.R.U. began to expand, and in 1941 their aircraft ranged over the German North Sea ports and the Dutch, Belgian and French coasts. Detachments were sent to Gibraltar to keep an eye on Vichy shipping around Dakar and Casablanca, to the north of Scotland and to the west of England. About this period, also, P.R.U. began to undertake low-level photographic work in addition to its normal high-altitude work. As one young pilot put it, "When the Navy wants to know how many rivets some Jerry battleship has on its gun turrets, you can't snap it from the sub-stratosphere; it means coming down to a few thousand feet, which gives him a grand chance to get extremely interested in you!" This perilous job promptly became known to P.R.U. as "dicing," the significance of which is obvious.

When the Mosquito came into service early in 1942, P.R.U. was able to extend its reconnaissance far into the



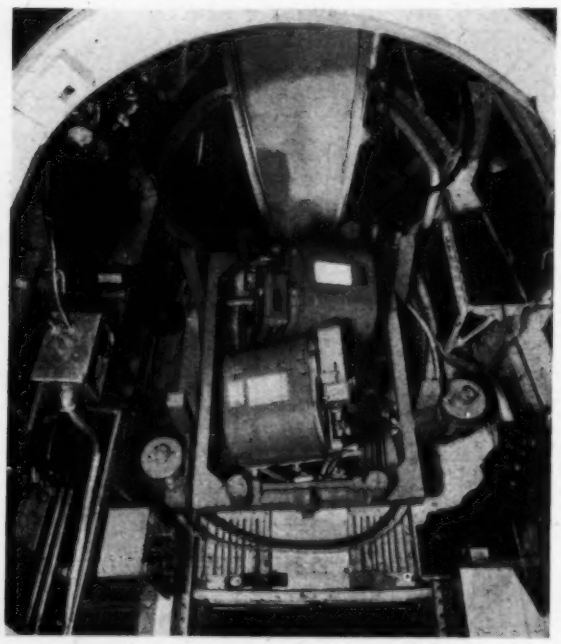
Cut-away sketch of the F.8 automatic camera with 20in. focal length.

PHOTOGRAPHIC RECONNAISSANCE

WIZARD PRANG! Intelligence officers of the P.R.U. make a stereoscopic examination of pictures showing the results of Bomber Command's visit to an enemy target, and assess the damage inflicted on it.

Baltic, to Genoa and to Spezia. Incidentally one pilot, returning from Spezia, broke cloud over France in his new ultra-long-range Spitfire with only five gallons of fuel left, but by gliding and using his engine sparingly he managed to make England. Mosquito pilots of P.R.U. have lunched in Russia and Tunis and been back at their British base in time for dinner—with their cameras full of valuable photographic "gen."

The great requisites in a good P.R.U. pilot are high-level map reading and individualism, for the work of Bomber Command these days often makes striking changes to the "map" thousands of feet below them. The Mohne dam was a typical example of this, for the spreading flood waters completely altered the appearance of the adjacent country and made it very difficult to recognise. So exacting and important is the work that whereas the pilots were at one time drawn from other Commands, the P.R.U. now has its own O.T.U. to give highly specialist training.



VEE TWIN: This shows how the twin cameras are set at an angle to increase the field of coverage.

HARDLY A V.P.K.: Somewhat larger than the one he takes on his holidays, this F.52 automatic camera with 36in. focal length telephoto lens is one of the two standard types used by the P.R.U. in their high-altitude work.

The cameras used are the F.52 with a focal length of 36in. and the F.8, with a focal length of 20in. They are automatic, and all the pilot has to do is to set the speed, height, etc., on the small control panel and switch on when making his run over the target. The Spitfire has two cameras, mounted behind the pilot at a slight angle to the vertical to increase their coverage. The Mosquito has five cameras and a pair of drop tanks under the wings provide additional fuel. Extra tanks are also fitted to the Spitfire.

High speed is the keynote of the processing work as well as of the aircraft. The films are developed mechanically, passing through the developing and fixing tanks and emerging through the wall of the darkroom via a light trap into the washing tank and a drying drum. They are then rushed to the Intelligence department for preliminary examination, after which they return to the processing department, where prints are made by a similar mechanical process.

Work in this department knows no fixed hours. Sometimes the men and W.A.A.F.s carry on till midnight, and on a really busy day have produced over 15,000 prints from 500 negatives.

"We work until the job in hand is finished, regardless of the time," said the officer in charge, who showed the same keen enthusiasm for his job as did the pilots themselves, "and we can turn out 960 prints an hour."

A healthy atmosphere of friendly rivalry exists in the P.R.U. between the Spitfire and the Mosquito pilots. The former are justifiably proud of the fact that they work alone and thus have to do everything themselves. The Mosquito crews, on the other hand, have to tackle the more distant targets and are therefore exposed to discovery and attack for a longer period. Both are convinced that they have the world's finest aircraft, and that is as it should be.

German Aircraft Structures

Universal Use of I-section Wing Spars : Fuselage Construction Characterised by Few Formers and Numerous Stringers

FROM time to time we have dealt in this journal with the design and constructional features of captured enemy aircraft. The Ministry of Aircraft Production has had an examination made of eight German aircraft types, and in the following article a comparison is made which reveals the main trends in German aircraft design.

STRUCTURAL features of the Do 217, Me 210 and Fw 190 are described in detail in the following report, and features of interest in most other types of German aircraft which have been in service over this country are also mentioned.

Eight main types of aircraft in service with the *Luftwaffe* have been examined in detail. These types are as follows:—

Firm	*Type*	*Duty*
Heinkel	He 111	Bomber
Junkers	Ju 87	Dive Bomber
	Ju 88	Bomber and dive bomber
Dornier	Do 217	Bomber and dive bomber
Messerschmitt	Me 109	Fighter bomber
	Me 110	Fighter bomber
	Me 210	Fighter, dive bomber and ground attacker
Focke-Wulf	Fw 190	Fighter bomber

Of these types, the Do 217, Me 210 and Fw 190 are the most recent designs, and the He 111, Ju 87 and Me 109 the oldest. The structural features of the three latest types are described in detail in the following notes, only features of particular interest in the other types being mentioned. In the last four of the types listed the design is notable from the point of view of ease of production, maintenance and interchangeability of major components. Weight summaries are given in an appendix at the end of this report, for the Fw 190, Me 109F and Do 217. (See next week's issue.—Ed.)

Wings

Fw 190:—The wings of all these types are of stressed-skin construction, but only in the Fw 190 does the skin take more than torque and drag loads.

Fig. 1 shows a bottom plan view of the Fw 190 wing and indicates the positions of the various large doors and cut-outs in the top and bottom surfaces. The main spar passes right through the fuselage and in the centre section is very strong, consisting of a built-up I beam with a solid plate web and each flange formed by a pair of angles formed from strip placed back to back and riveted together through the web. To the outside of each pair of flange angles is riveted a doubling plate 1in. thick at the centre and tapering to ⅜in. at 5ft. from the centre line, after which it tapers rapidly to nothing. The angle sections alone form the flanges from this point onwards, and these also are machined to taper towards the tip. The web remains the same thickness throughout the length of the spar. The spar is connected to the fuselage by two vertical bolts passing through lugs attached to the top flange. The rear spar is of similar construction but is pin-jointed to the fuselage. The flange angles are of lighter section and the doubling plates near the root are only ⅛in. thick at their thickest point, about 2ft. from the pin-joint, tapering off to nothing in both directions.

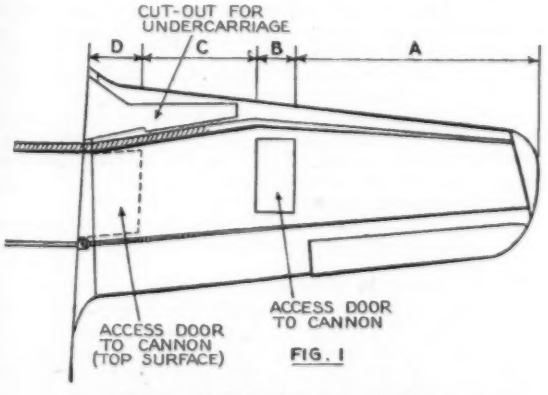
The manner in which the wing torsion is taken in this machine is interesting. Referring to Fig. 1, it will be seen that in the outer part of the wing (Section A) torsion is taken by the box formed by the front and rear spar webs and the top and bottom skin, the D-nose being of small proportions. In Section B of the wing, torsion is carried past the access door in the lower surface mainly by the spars, assisted by the small D-nose. In Section C the torsion is again taken by the box formed by the spars and skin. In this part of the wing the spar flanges rapidly begin to thicken up, as indicated by the hatching in Fig. 1, and all the bending is transferred to the main spar due to the pin joint in the rear spar. The manner in which torsion is taken in the most inboard section of the wing, where there is a large door in the top surface, is indicated in Fig. 2 and the reason for the doubling plates near the root of the rear spar will be seen.

As in many of the German designs, the ribs are few in number. In the Fw 190 they consist of plate webs with their edges turned over to form flanges to which the skin is riveted. The rib flanges are cut away to clear the spanwise stringers, and the webs are pierced with lightening holes with the edges turned over for stiffening.

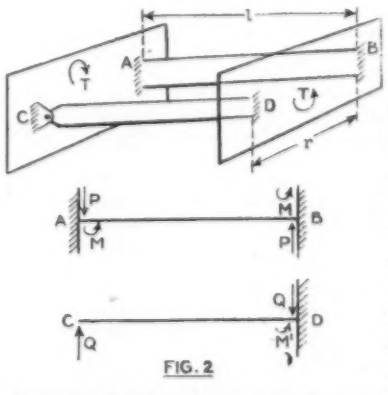
No chordwise stiffeners are used, but there are a number of spanwise stringers on the top and bottom skins, spaced at 3¼in. apart. The stringers are Z-section 1¼in deep by 1¼in. wide by 16 s.w.g. and are continuous, passing through flanged cut-outs in the ribs.

Do 217:—The Do 217 wings are built in three sections, comprising the two outer wings, each 16ft. long, and the centre section, 30ft. long, which is integral with the fuselage centre section and carries the two engine and undercarriage nacelles and the main fuel tanks.

The wing and fuselage centre section is entirely of metal construction and is built around two N-girder spars. The spar booms are basically thick I section light alloy extrusions, but with the addition of thinner extensions at each edge of the horizontal flange to enable the skin to be riveted on flush



Fw 190. Bottom plan view of wing.



Fw 190. Torsion at wing root cut-out.

GERMAN AIRCRAFT STRUCTURES

with the main part of the flange. The spar booms are machined to taper slightly towards the tip, and it is thought that the steps which form the edges of the horizontal flange are machined also and are not produced by the extrusion process. A similar method of construction is used in the He 111, except that in this case angle-section spar booms are used. In these two designs the flanges form part of the wing surface, and the spar, therefore, has the greatest possible effective height for the type of section used.

The Do 217 spar booms are braced by vertical and diagonal members of T-section and in the centre section by an additional thin sheet-metal web. The sketches, Figs. 3 and 4, show the construction of the spars at the centre section. The vertical and diagonal bracing members are attached to the spar booms by countersunk rivets. On the front spar the diagonal members are stiffened by lengths of angle riveted to the flanges of the T-section in Fig. 3.

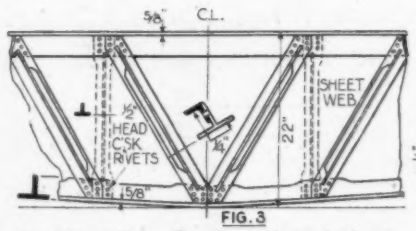


FIG. 3

Dornier 217E-1. Front spar from the front-centre section.

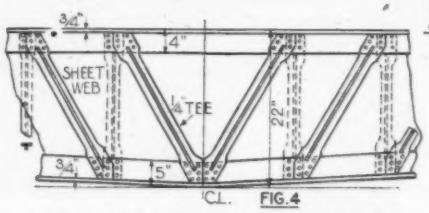


FIG. 4

Dornier 217E-1. Rear spar looking forward —centre section.

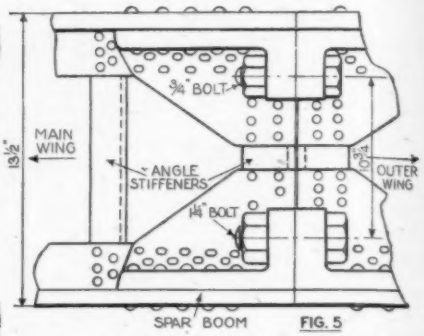


FIG. 5

Spar joint between main and outer wings.

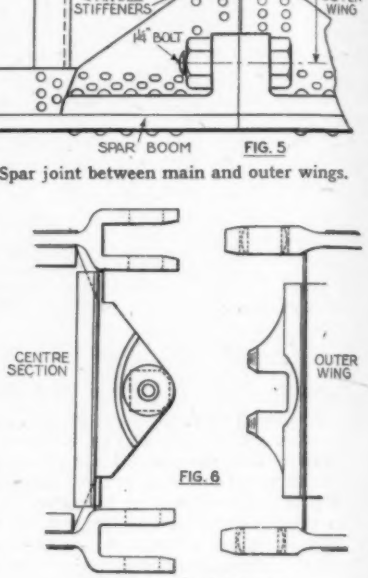


FIG. 6

Wing joint of Me 210.

The main wing ribs are T-section light alloy extrusions shaped to the wing profile, with sheet webs stiffened by vertical channels and angles. The two ribs that form the upper part of each side of the fuselage centre section have solid plate webs with vertical 2in. by 1in. by ⅛in. angle stiffeners in pairs 4in. apart at 18in. pitch. In the trailing-edge of the wing the ribs are pressed Z-sections braced by a spanwise member of similar section.

Joggled and Flush-riveted Joints

The wing covering is of sheet metal, flush riveted, with the joints carefully joggled, thus presenting a very smooth finished surface. As in all the bomber types, very large rectangular panels can be removed from the underside of the wing to allow access to the tanks. These panels are secured by countersunk screws engaging with anchor stiffeners on the flanges of the spars and ribs. The panels are stiffened by Z-section stiffeners at right angles, mutually connected by riveting on diamond-shaped gusset plates.

Each of the outer wings is an all-metal structure similar to the centre-section wing. The spars are of the same built-up type, with machined T-section extruded booms and N-girder bracing. The main ribs are sheet-metal pressings formed to the wing profile with triangular flanged lightening holes in the web.

The outer wing is joined to the inner wing by eight bolts, two at the bottom boom and two smaller ones at the top boom of each spar. Fig. 5 shows the form of stiffening in the neighbourhood of the attachment bolts. In addition to these eight main bolts there is a ring of small bolts round the periphery of the wing section passing through angle-section flanges riveted to the inside of the wing skin.

No spanwise stringers are used in the Do 217 wings. The stiffening of the inner wing panels has already been described. In the outer wing Z-section chordwise stiffeners 2½in. deep by 1½in. wide by 18 s.w.g. with flanged lightening holes are used with a spacing of 8in.

Ju 88:—The spars of the Ju 88 are built-up I-section beams with very thick flanges. The concentration of material at the flanges is, of course, advantageous, but the skin is not attached directly to these flanges but to stiffeners and ribs which pass over the flanges. This results in a spar which is about 2in. less in depth than the wing throughout its length. The stiffeners are of top-hat section, spaced 5in. apart and are 1¼in. deep by 1¾in. wide by 24 s.w.g. No spanwise stringers are used.

Me 210:—The design of the Me 210 wing follows the general practice of previous Messerschmitt types, except in so far as the wing is divided into sections in a different manner, there being, as in the Do 217, a centre-section built as a single unit carrying the engine and undercarriage nacelles with the main spar passing right through the fuselage.

Single-spar Construction

A single spar of built-up I-section is used with a solid plate web stiffened by channel-section stiffeners placed vertically, 10in. apart. The spar flanges consist of extruded angle sections placed back to back and riveted through the web with two doubling plates on each flange. These latter are stepped down at intervals along the wing, and near the tip the flange angles are also machined away until finally only part of the front angle section remains. The spar flange width at the root is 5¾in., and at the tip is 1½in. In the centre section there is a light trailing-edge member which is also continuous through the fuselage. Solid plate ribs are used in the centre section; in the outer wing the ribs are pierced with lightening holes.

There are no chordwise stiffeners, but a small number of inverted hat section spanwise stringers ¾in. deep by 1¼in. wide are used.

The outer wings are connected to the centre section at the spar and at the leading-edge. The front connection is a Junkers-type ball joint. The main spar connection is illustrated in Fig. 6. It will be seen that a block on the web of the inner wing spar, pivoted for ease of assembly, slides into a recess in the web of the outer wing spar and ensures that only bending loads are taken by the flange

GERMAN AIRCRAFT STRUCTURES

joints, which also incorporate self-aligning bushes.

Fuselages

All the eight types of aircraft mentioned have fuselages of stressed-skin construction. In general, the designs are notable for the small number of transverse frames and the large number of stringers used. Tables 1 and 2 give details of the frames and stringers respectively in most of the types.

Ju 87 and He 111:—Only in the Ju 87 and the He 111 is there any connection between the stringers and frames. In the latter machine, however, the Z-section frames are placed inside the stringers and have no direct attachment to the skin, being riveted only to the stringers. This scheme, which is the only one which involves no cutting of frames or stringers, is, perhaps, the simplest possible construction. The skin panels are many feet long and only a few inches wide.

Fw 190:—The fuselage of the Fw 190 has 21 L-section stringers with one wide top-hat section stringer at the top. L-section transverse frames are used, about 18in. apart. The whole is covered with light-alloy sheeting cut in very large panels and flush-riveted. The fin is integral with the fuselage. Below the front end of the fuselage is a large panel, attached to the fuselage by countersunk screws, which gives access to the two fuel tanks. This panel is made from two large light-alloy sheets, the internal sheet being dished at about 5in. centres and attached to the external sheet by a single rivet at the bottom of each dishing, as well as by rivets round the edges of the panel. This method of construction gives a very stiff panel and is used also in the fin, in parts of the engine cowling, and for an inspection door in the side of the fuselage.

Do 217:—In the Do 217 the fuselage is built in three parts. The front fuselage contains the crew's compartment and is not remarkable in any way. The metal skin is stiffened by Z-section frames and T-section longitudinal stringers which are discontinuous at the frames. The centre fuselage is integral with the centre-section wing, as previously mentioned. The main fuel tank is housed in the upper portion between the wing spars, the lower portion forming the front end of the bomb bay. The fuselage sides in this section are stiffened by vertical members composed of Z- and angle-sections riveted together. These stiffeners are riveted to the skin at about 18in. pitch with a T-section between each one. The edges of the bomb door openings are reinforced by box-section longerons built up from angles and sheets.

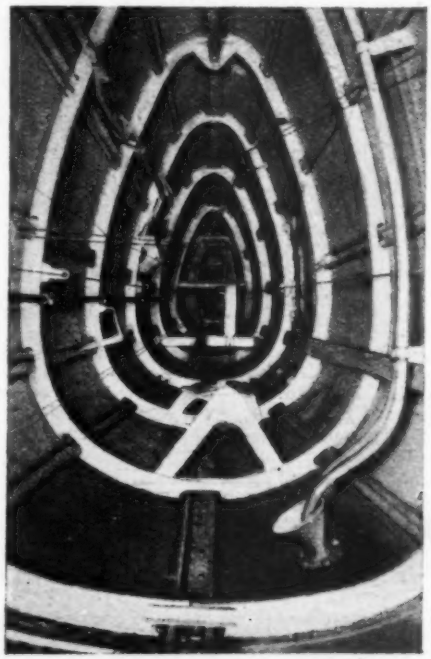


Fig. 7. Me 109. Rear fuselage construction.

The rear fuselage is approximately circular in section. The forward portion of the rear fuselage, which contains the after part of the bomb bay, is divided horizontally by a deck attached to a number of portal frames formed from pressed sheets with flanged lightening holes. The bomb beams are attached to the underside of the dividing deck. Above the bomb bay the skin is riveted to Z-section frames, which are cut away to allow passage of the longitudinal stringers, which are particularly closely spaced at the top. The edges of all openings are stiffened by angle sections.

The portion of the rear fuselage behind the bomb bay has openings for the retractable tailwheel, for the attachment of the tailplane, and at its extreme rear end, where the detachable dive-brake unit or dummy tail cap are fitted. In front of the tailplane opening is a diamond-shaped transverse frame with a vertical diagonal bracing strut. The opening at the extreme tail is finished off with a cross-shaped frame. Between these two frames are two others of crescent shape, each consisting of a pair of flanged pressings pierced with lightening holes, the front one being further stiffened by a pair of angles riveted along the top. These two frames carry the attachments for the tailplane.

Fuselage Connections

The connections between the three parts of the fuselage are made in each case by a large number of small bolts passing through flanges formed by extruded angle-sections riveted round the inside of the periphery of the fuselage section.

Me 210:—The most interesting method of fuselage construction is that used in the Me 210 and, in fact, in all the Messerschmitt designs mentioned. Top-hat section stringers are attached to the skin, each by a single row of rivets through the top. The skin and frames, 0.05in. thick, are integral, the two transverse edges of alternate panels being bent up to form Z-section flanges on the inside of the fuselage. These panels are also joggled along the transverse edges, so that flush skin laps can be made with the alternate plain sheet panels. The fuselage is built in two halves, with longitudinal seams along the top and bottom. The two halves are joined by two wide hat-section stringers using two rows of

TABLE 1.
Details of Fuselage Stringers.

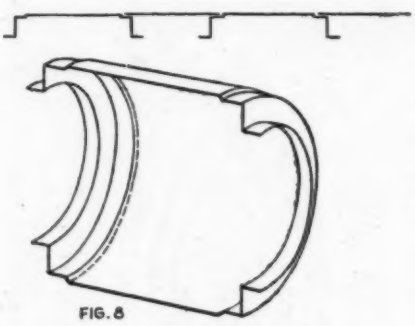
Aircraft type	Section	Overall width (in.)	Overall depth (in.)	Approx. gauge (SWG)	Riveting	Rivet Pitch (in.)
Ju 88	Bowler hat	2.0	0.7	Front 20 Rear 24	2 rows	3.0
Me 109	Inverted hat	1.5	0.75	—	Single row	1.6
Me 210	Top hat	2.2	0.65	16	2 rows	1.25
Fw 190	Lipped angle	0.825	1.25	16	Single row	1.0
Do 217,	Z-section	0.75	1.0	17	Single row	1.5

TABLE 2.
Details of Fuselage Frames.

Aircraft type	Section	Average spacing (in.)	Overall width (in.)	Overall depth (in.)	Approximate gauge (SWG)	Rivet Pitch (in.)
He 111	Z-section	20	1.5	2.0	—	Front 1.0
Ju 88	Z-section	17	1.0	2.0	18	2—3
Me 109	Z-section integral with skin ...	18	1.25	1.5	19	1
Me 210	Z-section integral with skin...	24	1.2	1.5	Front 17 Rear 18	Front 0.3 Rear 1.2
Fw 190	Lipped angle	15	0.6	2.0	18	0.9
Do 217	Z-section	20	1.5	1.5	18	0.75

GERMAN AIRCRAFT STRUCTURES

rivets in each, so that butt joints are formed. The other stringers pass through clearance holes in the integral formers and there are no gussets between the stringers and formers. The plating-former combination is evidently a pressing, and to combine such fabrication in one operation is of considerable advantage for large-scale production. Fig. 7 is a photograph of the inside of the Me 109 rear fuselage, which employs an identical type of construction, and Fig. 8 shows the form of one of the plating-former pressings.



Integral fuselage panel and formers.

Ju 88:—The Ju 88 fuselage is quite different and more complicated. In addition to a large number of stringers formed from strip, there are also four T-section extruded longerons. There is a total of 45 stringers, and the average spacing is about 3½in. The stringers are all continuous, and they are attached to the skin by two rows of rivets each. The frames are cut out for the stringers, which, however, are not connected to them. The construction of the Ju 87 fuselage is similar, except that the frames are connected to the stringers by angle brackets. The Ju 88 frames are riveted to the skin with a rivet spacing of 2 to 3 inches. The large number of stringers of this shape and method of attachment leaves very little unsupported skin. This result, while approaching a condition which is desirable theoretically, involves the use of at least twice the normal number of stringers and about three times the normal number of rivets.

(To be concluded next week.)

Accessory Before the Fact

D.P.E.A. Holds Exhibition at M.A.P.

THE idea that a series of exhibitions held fortnightly within the headquarters of the M.A.P. would serve a useful purpose by educating the staff generally, and also contractors' representatives visiting the Ministry, emanated originally from the Minister for Aircraft Production, Sir Stafford Cripps. These exhibitions have been a great success and highly appreciated by the staff, who have already gained a much clearer conception of the exact nature of the work conducted by the various Directorates and its importance to the war effort.

The most recent of these exhibitions is in connection with the Directorate of Production, Engine Accessories. The enormous responsibility of the P.E.A. Department is at once apparent from the numerous exhibits on view which, by the way, are not a fully representative collection by any means, for accessories still regarded as secret for obvious reasons cannot be included in the display.

M.A.P. Exhibition. (Centre) Mr. W. A. Davenport, Deputy-Director of Production (Engine Accessories), (left) Mr. J. Howland, assistant director of the same directorate.

Amongst this wide variety of exhibits are some outstanding examples which hint of progress being made by the British aircraft industry in certain directions behind those veils of secrecy. The compact Rotol compressor for air conditioning a pressure cabin at altitude arranged side by side with a Rotol auxiliary gear box were the first exhibits to attract our attention.

A further interesting exhibit was a sectioned electrically driven immersed fuel pump, very similar to the German type of pump. Next to this, and obviously of entirely different design, although not sectioned for obvious reasons, was the latest type of immersed fuel pump which, we gather, is a distinct improvement on the earlier design.

Prominent among the carburettor exhibits was a sectioned S.U. carburettor, negative G type, as fitted to the Merlin XX, and the S.U. carburettor, as fitted to the Napier Sabre II.

Numerous magnetos were exhibited, including B.T.H. and Rotax types. One of very special interest was the Simms F.S.T. 14/S magneto for high-altitude flight.

The section devoted to sparking plug exhibits included the complete "breakdown" of an A.C. plug assembly. Ignition screening harness for the Armstrong Siddeley Cheetah engine was prominent in this section.

The ignition screening harness for the Napier Sabre II correctly assembled upon a "mock-up" was also displayed adjacent to the main exhibits.

Numerous other accessories included compressors, engine-driven fuel pumps, vacuum pumps, hydraulic pumps, Coffman starters, voltage booster, header tank relief valves and fuel tank pressure control valves, the latter being sectioned.

The pre-war demand for any one of these accessories on view would have been in the region of 250 per month. This figure has risen until it now exceeds 10,000 per month, which gives one some idea of the business involved in providing the R.A.F.'s engine accessories, to which should be added experimental and research work entailed in providing for future requirements.

British Aviation Loses Two Renowned Workers

Mr. L. F. G. Butler

COLLAPSING on Paddington station, London, last Friday, Mr. L. F. G. Butler died suddenly of heart failure. It had been thought that he had completely recovered from the illness from which he suffered some months ago, and that the post of technical adviser to the engine division of the Bristol Aeroplane Company would be better within his physical capacity than the previous post of chief designer, which he had to relinquish on account of his illness.

From Sir Roy Fedden, with whom Mr. Butler was so closely associated for practically the whole of his engineering career, we have received the following appreciation:—

"Lionel Butler and I first worked together at the drawing board side by side in 1907 on the design of the first Straker Squire car, and we were jointly responsible for subsequent Straker Squire car designs. When I was technical director of the Cosmos Engineering Co. during the latter part of the last war, Mr. Butler worked with me as chief designer on the first Mercury and Jupiter aircraft engines.

"In 1920, Mr. Butler was one of the first to come with me to form the Aero Engine Department of the Bristol Aeroplane Co., where he was chief designer until 1940.

"Throughout this long association, extending over 30 years, Mr. Butler was a most loyal collaborator, and became one of my oldest friends. I learnt to have the highest regard for his criticism of engine design. His fine ability on detailed mechanical design had a strong influence on the success of the engines resulting from our association.

"Mr. Butler always devoted his whole energy single-mindedly to the good of the engine, and he redoubled his efforts during the late 1930s in the firm conviction that war was inevitable, and that the technical quality of engines for the Royal Air Force was essential.

"During his period as chief designer of the Bristol Aeroplane Co., no drawing of any consequence ever reached the shops without his personal inspection, and he had an extraordinary ability to pick out any weak spots at a glance.

"In order to achieve the standards he set himself, he made the job his hobby as well as his work, and we spent many long evenings and week-ends together in thrashing out details of the engine.

"It was sad that ill-health prevented him from taking the same part after September, 1940, but his advice and mechanical appreciation were still as keen and valuable as ever, and while his death is a loss indeed to his family and his many friends and to British aviation, the strong influence of his work remains amongst the engines flying in Royal Air Force machines to-day." A. H. R. F.

Dr. H. C. H. Townend

AERODYNAMICS has lost one of its greatest investigators in the death of Dr. H. C. H. Townend, who last week lost his life in an aircraft accident while observing a full-scale test. Mr. Griffith Brewer writes of Dr. Townend:—

His name will always be remembered as the inventor of the Townend Ring, which by robbing the radial engine of a portion of its air resistance enabled 10 per cent. to be added to the speed for the same amount of horse-power. The Townend Ring was a pioneer improvement which broke into a long run of parasitical air resistance, and which also led the way to better cooling of the radial air-cooled engine, with the result that when we look to the power units on aircraft of to-day, we can recognise the Townend ancestor in the cowlings and other obstruction-reducing devices which have contributed so greatly to economy in power and consequent increase in speed.

As Mr. J. D. North remarked when discussing Dr. Townend's Paper on his Ring, read before the Royal Aeronautical Society on March 6th, 1930, the Townend Ring was the second of the only two aerodynamic inventions which had been made in the last decade. Handley Page's slot had enabled aircraft to go slower and now the Townend Ring had enabled them to go faster.

The invention of the Townend Ring in England corresponded to the independent experiments carried out in America on the N.A.C.A. Cowling, and these two inventions merged together until the cowling which can be seen enclosing almost every air-cooled radial engine to-day can be traced to the original Townend source.

The ring is made of aerofoil cross section having an outward lift coefficient which holds the air towards the engine axis and which in the longer types of ring permits the exit of the air around the fuselage to be controlled in its freedom to escape.

Besides his great work in investigating aircraft resistance Dr. Townend had a high degree of mechanical skill. One example may be mentioned when he made a model bicycle on which a doll sat upright like an athlete and then as it slowed down it banked to right or left, in ever-reducing circles.

He contributed other Papers to the Royal Aeronautical Society, on "Flight by Human Power" and "An Automatic Variable-Pitch Airscrew."

Dr. Townend's tall figure will be sadly missed, but not more than his kindly manner and his willingness to help others working in the field in which he had made a master position for himself. G. B.

BIGGIN HILL'S MEMORIAL

GROUP CAPT. A. G. MALAN, D.S.O. and Bar, D.F.C. and Bar, famous Battle of Britain fighter pilot, is to unveil a memorial on Sunday, September 19th, to the dead and missing pilots of the Biggin Hill sector. They number more than 200 from the beginning of the war down to the present.

The memorial is in a new chapel of remembrance at Biggin Hill R.A.F. Station, Kent. The chapel—a station building adapted for worship—will be opened by the Rev. M. H. Edwards, O.B.E., R.A.F. Chaplain-in-Chief, who will also dedicate the memorial. The pilots' names will be recorded on an altar reredos in the chapel and inscribed by hand in a book of remembrance. Badges of the squadrons who have operated in the sector will also form part of the memorial.

Next of kin of the dead and missing pilots have so far subscribed £500 towards the memorial, which is the idea of Squadron Leader Cecil King, the Church of England padre at Biggin Hill, who was mentioned in despatches for his part in the Battle of Britain.

Any surplus of the money subscribed will go to the R.A.F. Benevolent Fund and to the R.A.F. Prisoners of War Fund. The memorial is to be a progressive record, and will close only with the end of the war.

SWEDISH TRANSPORT LOST

THERE is still, at the time of going to press, no news of the Swedish transport aircraft which left Scotland recently on a flight to Stockholm. The machine, a D.C.3, belonged to the A.B. Aero Transport, and left in company with two others. The last radio signal was sent out by the aircraft when it was some 200 miles off the Scottish coast, and from the fact that no distress signal was picked up it is to be assumed that whatever occurred happened suddenly. The possibility that the machine was shot down by German aircraft cannot be ruled out.

The D.C.3, the name of which was *Gladan*, was piloted by Mr. K. G. Lindner, who had with him Mr. Mörne as co-pilot, Mr. P. Persson as radio operator, and Mr. Werner as flight engineer. There were three passengers on board.

Lindner was chief pilot of the A.B. Aero Transport and the most famous of all Sweden's commercial pilots. He was a "millionaire" in the distance he had flown, and had taken part in many noteworthy flights.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"WHISPERING DEATH"

Virtue of Low-level Jungle Attack

IN reply to the letter by "Hércules" in *Flight*, August 19th, I would like to give him the explanation of the Japs' name for the Beaufighter as I have heard it.

It appears that Beaufighters in use in the South-west Pacific area have a habit of attacking Japanese troops from a very low altitude, and so in the jungle the sound of the engines is not heard until the aircraft is almost on top of them, hence the name "Whispering Death." ALBERT FISHER.

Peculiarity of Beaufighter Slipstream

THE answer to the query by "Hercules" in your issue of August 19th is probably as follows:

Most attacks on Japanese troops are low-level affairs, and an aircraft approaching at "nought feet" is never heard until it is quite near. In bush or jungle this characteristic is probably even more pronounced, added to which it may be that the type of exhaust system employed on the Bristol Hercules engine lends itself still further to this peculiarity.

But that is only half the story. If my information is correct, the vortices, or disturbed eddies of air, left behind by the low-flying Beaufighter make a curious "wuffling" sound (more easy to imitate than to describe in words) which is heard after the sudden brief roar of the engines, the crackle of guns and/or bomb explosions have come and gone.

This would appear to be a peculiarity of the slipstream, possibly from the nacelles and airscrews, but to the superstitious Orientals it may well be taken to represent the ascending spirits of their comrades who have just been killed.

At all events, it seems to be that curious "wuffle, wuffle" which has given rise to the name of "Whispering Death" where the Beaufighter is concerned. "REALIST."

SUPER-SONIC SPEEDS

Any Claim Over 600 m.p.h. Discounted

REPLYING to "Toolmaker" (*Flight*, August 26th) very few aircraft are able to reach 600 m.p.h. in the dive, so that reports of much higher speeds are to be discounted. This speed, which will not vary much with height or the weight to size ratio of the aircraft, is less than that of sound, and hence "subsonic."

Under these conditions the air speed indicator is quite able to give a close measure of the speed reached. This instrument is calibrated to give true speeds at ground level, departures from the speed² law, due to compressibility being automatically taken into account.

At altitude, however, allowances have to be made for the reduced air density and for the fact that the speed of sound, and hence compressibility effects vary with height. The corrections to be applied are, however, well understood.

Incidentally, the prospects of substantially increasing diving speeds beyond the above value are doubtful, and it seems likely that man may have to be content with a mere 650 m.p.h.!

H. C. SMITH.

BOMBER ARMAMENT

Short-range Visibility at Night

IN your Correspondence page in *Flight* dated August 26th, Mr. A. T. Henshaw says that he would like to see the installation of the 0.50in. machine gun on our night bombers as a better defence against enemy night-fighter attacks. I am afraid that I must disagree with this. I realise that the 0.50in. is an excellent weapon, but only for day bombers. In daylight you can see the attacking fighters when they are many miles away, and then the 0.50in. can be used with good effect, and at a considerably greater range than the 0.303in.

At night, however, the position is reversed; you cannot see the attacking fighter until he is manœuvring into position to attack; if you see him then, often the first thing a gunner knows of his presence is a sudden burst. If, however, you had the 0.50in. gun installed, say, two in the rear gun turret, and the gunner saw the attacker at a range of a mile or two, before the fighter had seen him and gave a burst at it, the flash from the gun muzzle would give his position away, and would also temporarily blind the gunner, and this would prove disastrous to the rest of the crew. In our night fighters, where they have a heavy gun or guns fitted, the armament is so arranged that, when fired, the pilot is not dazzled by the gun flashes, like in the Beaufighter and Mosquito with the cannons in the belly.

Mr. Henshaw also says that the Mosquito and the Typhoon should be used exclusively for attacking small targets in daylight and leave the larger targets for the Fortresses. As far as I know, this has always been the case. I cannot recall that Fortresses have ever made a daylight raid on a small target.

Whilst writing, I would like to thank you and all those responsible for the articles on various aircraft engines giving constructional details and performance figures, etc. These are of the utmost interest to me, and I am looking forward to more of them J. BAMSEY.

TECHNICAL TRAINING

Reshuffle of Existing Experts Desirable

REFERRING to the findings of the Select Committee on National Expenditure on the shortage of scientific and technical personnel in the aircraft industry, and to Mr. Geoffrey Smith's letter quoted in *Flight* of August 26th, can it be said that best use is being made of those in the industry, including official establishments, quite apart from any question of men being called up for the Services and then unsuitably employed?

It may be true that in the early stages of rearmament there was excessive staff turnover, but I doubt very much whether steps taken then and since the war to check this have been altogether beneficial. Some firms' technical staffs probably are, and have been over long periods, much less fully occupied than others, and as regards the official side, the disadvantage of employing so many who have no industrial experience whatsoever are apparent. Much more interchange seems desirable, and in fact, even at this date, a fairly general reshuffle would, I suggest, be all to the good.

J. LOCKWOOD TAYLOR, D.Sc.

CIVIL AVIATION

Will Not Oust Ship or Train

MAY I use a little of your Correspondence space on the much discussed subject of post-war air transport, which will doubtlessly grow extensively after the war.

Many farsighted people imagine that nearly all post-war transport will be done by air. This is highly impracticable.

It would take about fifty transport aircraft to do the work of one freight train of about fifty trucks—one aircraft per truck. Besides this, the aircraft would require about nine times as much oil and twenty times as many men as the train. Also the cost of the aircraft, pay for personnel, etc., would exceed thirty times that of the train.

Nevertheless, the aircraft has its advantages (i.e., speed and being able to travel over land and sea alike, etc.) and will be used a fair amount.

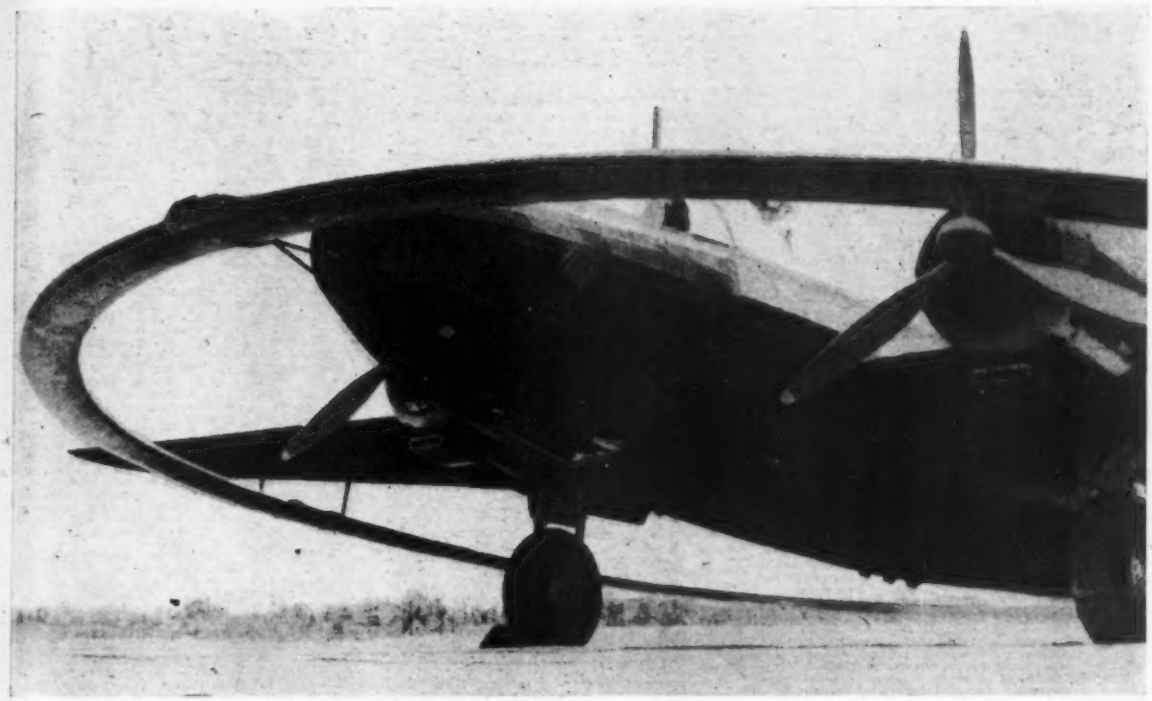
A man crossing the Atlantic is usually glad to see the back of it, so he will go by air, and consequently be over it quickly. But travellers in the more beautiful parts of the world will probably prefer a ship, the slower speed giving them plenty of time to see the sights.

Many aircraft already in use should prove to be good post-war transports. The Constellation, York, Stratoliner, Skymaster, Condor and Junkers Ju 290 (90s) are very good transports, ranking in about the order set out above.

There are others which are fairly good craft, such as the Commando, Junkers 90, BV142 and the Albatross. These large machines would operate on the trans-ocean and trans-continental services.

There are, as well, some very good flying boats, either in service or expected to come into service. The Martin Mars, 314A Clipper, Empire class and BV222 are excellent in seaworthiness, etc. These would have much the same specified jobs as the pre-mentioned land craft.

Small, private aircraft for sale or hire would be predominant. Such communications craft as the Fieseler Storch, the Argus the Vigilant and the Messerschmitt MM 108B are outstanding, being cheap to build and easy to fly. R. E. GREGORY.



One of the special "Wedding Ring" Wellingtons used to combat Germany's secret weapon—the magnetic sea-mine. The ring is an electro-magnet which explodes the mines when flown low over the channels in which they lie. The ring weighs 2½ tons and is energised by a Vee 8 Ford engine in the fuselage.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Appointments

Air Vice-Marshal R. GRAHAM, C.B., C.B.E., D.S.O., D.S.C., D.F.C., has been appointed Air Officer Combined Operations in place of the late Air Vice-Marshal A. H. Orlebar, C.B.E., A.F.C.

Air Comdre. Strang Graham, M.C., G.M., has been appointed Director of Air Force Welfare at the Air Ministry, having previously been Deputy Director.

Awards

Far East

THE KING has been graciously pleased to approve the following appointments and awards in recognition of conspicuous service in operations against the Japanese:—

M.B.E. (Mil.)

Flt. Lt. J. T. ALLEY, R.A.A.F.
Flt. Lt. W. J. CLARKE, R.A.A.F.
Flt. Lt. G. A. EVERINGHAM, R.A.A.F.

Distinguished Flying Cross

Sqn. Ldr. S. AUSTIN, R.A.A.F.
Wing Cdr. D. W. COLQUHOUN, A.F.C., R.A.A.F.
Sqn. Ldr. L. A. DOUGLAS, R.A.A.F.
Sqn. Ldr. V. A. HODGKINSON, R.A.A.F.
Sqn. Ldr. C. C. LEARMONTH, R.A.A.F.
Sqn. Ldr. A. G. H. WEARNE, R.A.A.F.
Act. Sqn. Ldr. K. M. KEMP, R.A.A.F.
Flt. Lt. R. W. FOSTER, R.A.F.V.R.
Flt. Lt. R. M. HIRST, R.A.A.F.
Flt. Lt. F. K. MORCOMBE, R.A.A.F.
Flt. Lt. N. V. ROBERTSON, R.A.A.F.
Flt. Lt. W. K. BOLITHO, R.A.A.F.
F/O. I. C. CURTIS, R.A.A.F.
Flt. Lt. V. H. HUNT, R.A.A.F.
Flt. Lt. J. S. MERCER, R.A.A.F.
F/O. P. C. MULLENS, R.A.A.F. (since deceased).
Flt. Lt. R. A. WINES, R.A.A.F.

Distinguished Flying Medal

Flt. Sgt. A. E. COLE, R.A.A.F

THE growth of the R.A.F. and the increasing number of deeds of valour have proved too much for our supply of paper. With great regret we must omit citations for the awards of D.F.C. and D.F.M., but when a bar to either is awarded the original citation will be quoted where possible.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry displayed in flying operations against the enemy:—

Bar to Distinguished Service Order

Act. Wing Cdr. A. WARBURTON, D.S.O., D.F.C., No. 683 Sqn.—This officer has undertaken a very large number of reconnaissance flights over a wide range of targets in the Middle East theatre. On one occasion in December, 1942, he made a low-level flight over Naples and achieved success in the face of heavy anti-aircraft fire and fighter opposition. Wing Cdr. Warburton's great courage and devotion to duty were well illustrated during a reconnaissance of Pantellaria in May, 1943. Although his aircraft was continuously subjected to fire from the coastal batteries, he skilfully accomplished his task securing information of the highest importance.

Distinguished Service Order

Act. Sqn. Ldr. P. J. CUNDY, D.F.C., No. 224 Sqn.—Since being awarded the D.F.C. this officer has been almost continuously engaged on operations. In February, 1943, during an anti-submarine patrol he executed two attacks on U-boats. During a flight in July, 1942, Sqn. Ldr. Cundy sighted a U-boat. In spite of heavy opposing fire from the vessel, which damaged his aircraft and disabled one engine, he pressed home two vigorous attacks, straddling the U-boat with his depth charges. Afterwards a large patch of oil appeared on the surface of the water.

Flt. Lt. A. J. HODGKINSON, D.F.C., No. 23 Sqn.—This officer has completed much operational flying. Latterly, in the Middle East, he has attacked targets in Tunisia, Italy and Sicily, and, during these operations, he has attacked numerous locomotives to good effect, while fires have been started in railway installations and sidings as a result of his determined work. In addition, Flt. Lt. Hodgkinson has executed many sorties over enemy airfields, during which he has destroyed three hostile aircraft and caused much disorganisation.

Act. Wing Cdr. C. E. MARTIN, D.F.C., R.A.A.F., No. 460 (R.A.A.F.) Sqn.—Since being awarded the D.F.C. this officer has taken part in numerous sorties, including a flight to Turin, which was successfully attacked and photographed. On a recent occasion his fearlessness and promptitude were instrumental in saving an aircraft from destruction when it caught fire on the ground. Although the bomber was fully loaded and smoke was pouring from it, Wing Cdr. Martin leapt aboard and directed the efforts of the fire fighters in quelling the outbreak.

Bar to Distinguished Flying Cross

Act. Wing Cdr. P. G. St. O'BRIAN, D.F.C.—Wing Cdr. O'Brian has completed a large number of sorties and has invariably displayed great keenness. On one occasion, when he had to abandon his aircraft over the sea, he was subsequently adrift in his dinghy for eight hours before being rescued. Despite this, he led his formation on its next operation.

F/O. J. A. MCCAIRNS, D.F.C., M.M., R.A.F.V.R., No. 161 Sqn.—This officer has completed numerous sorties, displaying a high degree of skill and determination throughout.

Distinguished Flying Cross

F/O. E. H. E. HEARN, No. 50 Sqn.—For Citation see Sgt. Wilkie, C.G.M.

Act. Sqn. Ldr. H. S. JACKSON, R.A.F.V.R. No. 125 Sqn.

Act. Sqn. Ldr. R. A. V. SALMON, R.A.F.V.R., No. 40 Sqn.

Flt. Lt. V. F. GANDERTON, R.C.A.F., No. 427 (R.C.A.F.) Sqn.

F/O. F. W. HORBY, D.F.M., No. 40 Sqn.

F/O. J. G. WYNNE, R.A.F.V.R., No. 40 Sqn.

P/O. F. G. CRACKNELL, R.A.A.F., No. 100 Sqn.

P/O. S. SLATER, R.A.F.V.R., No. 100 Sqn.

Sqn. Ldr. W. I. LASHBROOK, D.F.M., No. 102 Sqn.

SERVICE AVIATION

F/O. A. MARTIN, R.A.F.V.R., No. 102 Sqn.
F/O. G. BENNETT, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
P/O. J. BARRASS, R.A.F.V.R., No. 15 Sqn.
Flt. Lt. F. C. COLBORNE, R.C.A.F., No. 5 (R.C.A.F.) Sqn.

Conspicuous Gallantry Medal (Flying)

Sgt. C. J. M. WILKIE, No. 50 Sqn.—One night in June, 1943, F/O. Hearn and Sgts. Pointon and Wilkinson were air bomber, mid-upper gunner and flight engineer respectively of an aircraft, piloted by Sgt. Wilkie, detailed to attack Cologne. Whilst over the target area the bomber was hit by anti-aircraft fire. The windscreen round the pilot's cabin was shattered and Sgt. Wilkie was blinded by flying splinters. Despite this, he remained at the controls. F/O. Hearn and Sgt. Wilkinson were injured by fragments of shrapnel. Nevertheless, the former uncomplainingly remained at his post ready to release his bombs, whilst Sgt. Wilkinson went to the assistance of his pilot, and the bombing run was completed. Still unable to see, Sgt. Wilkie remained at the controls, piloting his aircraft by touch, being aided in various ways by the flight engineer and by F/O. Hearn, who directed him in avoiding the searchlights and continuous anti-aircraft fire to which the bomber was subjected. Some time later, whilst still over enemy territory, Sgt. Wilkie recovered his vision in one eye and soon succeeded in flying clear of the defences, afterwards flying the aircraft back to this country. In the course of the action Sgt. Pointon had one finger severed when his turret was damaged by a shattering blow. Although in considerable pain, he remained at his post, constantly alert to the danger of fighter interference.

Sgt. G. DOWNTON, R.A.A.F.—This airman was the wireless operator/air gunner of an aircraft which, during a flight over Cap Bon, was engaged by ten enemy fighters. In the ensuing combat, Sgt. Downton was wounded three times, while his gun became unserviceable. Despite this, he coolly directed his pilot in taking the necessary evading action until the aircraft could no longer be flown and was landed, on fire, in enemy territory. With complete disregard of his own safety, Sgt. Downton, who escaped serious injury in the crash, entered the blazing wreckage and assisted in extricating a member of the crew who was badly burned. He then tried valiantlyy to re enter the rear of the aircraft to rescue a trapped comrade, but was finally beaten by the intense heat of the conflagration.

Sgt. E. T. G. HALL, No. 115 Sqn.—Sgts. Hall and Crewther were mid upper gunner and wireless operator respectively of an aircraft, captained by Sgt. Jolly, which attacked Cologne one night in June, 1943. On the homeward flight the bomber was intercepted by two enemy fighters and a running combat ensued. Sgt. Jolly took violent evasive action, but eventually a burst of gunfire from one of the attackers, at close range, hit the rear turret, setting the fuselage on fire between the bulk head doors. Sgt. Hall, the mid upper gunner, kept firing his guns, however, and the enemy aircraft was seen diving steeply and on fire. By this time the rear turret was well alight, and the fuselage became filled with smoke. The situation became critical, but Sgts. Hall and Crowther, without waiting to connect the portable oxygen supply, attempted to quell the flames. Both airmen became thoroughly exhausted, but gamely battled on, and, after a prolonged struggle, succeeded in extinguishing the flames; it was then discovered that the rear turret had fallen off. Eventually, Sgt. Jolly flew the damaged bomber to an airfield in this country, landing it safely.

Distinguished Flying Medal

Sgt. F. POINTON and Sgt. S. WILKINSON, both of No. 50 Sqn.—For citation see Sgt. Wilkie, C.G.M.

Sgt. W. P. JOLLY and Sgt. R. K. CROWTHER, both of No. 115 Sqn.—For citation see Sgt. Hall, C.G.M.

Flt. Sgt. D. C. CHALLIS, No. 40 Sqn.
Flt. Sgt. J. E. STAPLES, No. 126 Sqn.
Sgt. C. A. LAMBERT, No. 51 Sqn.
Sgt. R. HENDERSON, No. 83 Sqn.
Sgt. A. RODGERS, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
Sgt. H. G. TATTERSALL, No. 178 Sqn.
Flt. Sgt. F. LAWRENCE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.

Roll of Honour

Casualty Communiqué No. 274.

THE Air Ministry regrets to announce the following casualties on various dates. The next of kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of the names in this list, 85 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. G. N. Downward; Sgt. R. T. Morris; P/O. W. E. Pickup; Wing Cdr. J. M. Shewell; Act. Flt. Lt. E. M. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. C. E. Benstead; Sgt. R. W. Bowler; Flt. Sgt. D. Emeny; A/C.2 S. H. Fleet; Sgt. J. W. Humphrey; Sgt. F. T. P. Jones; Sgt. J. W. McL. Merry; Sgt. J. R. Roberts; P/O. F. C. Smith; Sgt. R. Vallance; Sgt. D. Wilkie; Sgt. B. W. Williams; P/O. W. O. Williams; Sgt. P. Witcomb.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. E. Adams; F/O. D. Anderson; P/O. W. S. Brimble; Sgt. R. H. Burley; Sgt. R. W. Cadman; Sgt. R. W. Catlin; Sgt. S. Clare; Sgt. K. S. Cole; Sgt. J. C. Coulthard; Sgt. J. Davey; Flt. Sgt. W. H. Davidson; Sgt. J. H. Davies; Sgt. W. L. Doodson; Flt. Sgt. J. Farrell; Sgt. H. R. Feast; Flt. Sgt. R. S. Gibbons, D.F.M.; Flt. Sgt. K. Gill; Sgt. A. J. Greenway; Flt. Sgt. R. H. Gresham; Sgt. H Hewitt; Sgt L. Jackson; Sgt. W. Johnstone; F/O. R. Jones; Sgt. T. A Jones; P/O. R. R. Kemp; Sgt. F. Logan; Sgt. R. H. Macintyre; Sgt. J. W. Morgan; P/O. H. Pearce; P/O. S. C. Pearse; Sgt. A. S. H. Powell; Sgt. H. Ross; Sgt. H. Rossbottom; Flt. Lt. D. C. Sharman; P/O. C. P. Shaw; Sgt. J. T. Spirit; Sgt. F. G. Tredinnick; Sgt. L. T. Vince; Sgt. M. F. N. Wadham; Sgt. T. Wakefield; Sgt. T. H. Walpole; Flt. Sgt. K. H. Watson; P/O. R. MacK. Watson; Sgt. H. M. Webb; Sgt. D. J. Wood; Sgt. J. A. Wright.

WOUNDED OR INJURED IN ACTION.—Sgt. C. D. Cheeswright; Flt. Sgt. E. J. Clinch.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. S. C. Glover.

MISSING, BELIEVED KILLED IN ACTION.—Wing Cdr. R. G. Barrell, D.S.O., D.F.C.; P/O. H. B. Barrett; Sgt. S. H. Burrows; Sgt. R. H. Cookson; Sgt. J. E. Dean; F/O. W. A. Donnelly; Sgt. C. Gorton; Sgt. B. Kermode; W/O. E. G. Pointer, D.F.M.; Sgt. L. L. Seal; Sgt. P. Stephenson; Sgt. R. Whitfield.

MISSING.—Flt. Sgt. E. W. Alexander; Sgt. P. C. Andrews; Sgt. W. G. Arthur; Sgt. F. C. Ashby; Sgt. W. Barry; Sqn. Ldr. A. Beck; Act. Wing Cdr. W. O. V. Bennett, D.F.C., A.F.C.; Sgt. E. C. Bishop; Sgt. N. Blanchard; Sgt. L. A. Bone; Sgt. I. H Bradley; Sgt. C. W. Broadbent; Sgt. E. W. H. Browne; Sgt. S. C. Carter; Sgt. N. A. M. Cawthra; Sgt. G. N. Cochrane; Sgt. P. E. Collingwood; Sgt. S. Cowgill; Sgt. W. Cox; F/O. J. D. Danks; Sgt. J. W. Darroch; F/O. A. J. Davis; Sgt. L. L. Davis; Flt. Sgt. L. Debotte; Sgt. C. Easton; Sgt. R. L. Edgoose; F/O. H. Emmerson; Sgt. A. W. Erne; Sgt. R. H. Evans; Sgt. F. Fazackerley; F/O. L. G. Flynn; Sgt. J. A. Francis; Flt. Sgt. R. F. Garrod; Sgt. G. George; Sgt. R. Gilbert; Sgt. H. R. Glover; Sgt. N. Goldie; Sgt. F. Groom; F/O. J. F. Hanrahan; Sgt. E. Harper; Sgt. A. C. Harris; Sgt. C. W. Hartin; P/O. R. G. Higgins; P/O. H. J. Hudson, D.F.M.; P/O. E. C. Hughes; Sgt. A. R. J. Hunt; Sgt. G. R. Jacques; Sgt. A. Jarman; Sgt. B. A. W. Jennings; Sgt. W. H. Jewels; F/O. R. J. Johnson; Sgt. G. Jones; P/O. S. G. Keatley, D.F.M.; Sgt. P. A. Kennedy; Flt. Sgt. R. A. Kerckhove; Sgt. C. K. Killick; Sgt. C. F. King; Sgt. H. Levine; Sgt. G. Liddle; Sgt. T. E. Lloyd; Sgt. I. McCrae; Sgt. J. Malpas; Flt. Lt. J. L. Moore, D.F.C.; P/O. K. G. Mott; F/O. E. R. Muller-Rowland; Sgt. S. Naisner; Sgt F. Needham; Flt. Sgt. A. V. Newell; Sgt. K. R. Newton; Sgt. G. C. Norton; Sgt. D. O'Sullivan; Sgt. H. S. Puget; Sgt. T. S. Payne; Sgt. R. D. Pryde-Watson; Sgt. H. R. Pyle; Sgt. W. C. Rowlands; F/O. J. H. Sams; Sgt. F. W. Sanderson; Sgt. G. I. Simpkin; Flt. Sgt. W. Slater; Sgt. E. H. Stanton; P/O. W. J. Stephen, D.F.M.; Sgt. J. M. Sweeney; Sgt. P. J. Taylor; P/O. C. E. Thompson; Sgt. G. Thompson; Sgt. J. Thomson; Sgt. G. C. Tisbury; Flt. Sgt. A. Tomlinson; Sgt. D. T. Toohig; P/O. N. B. Touzel; Sgt. E. Towe; Sgt. F. W. N. Trowbridge; Sgt. B. Veall; Sgt. K. E. Walters; Sgt. T. G. Wilkinson; Sgt. G. H. Williams; Sgt. J. G. V. Williams.

KILLED ON ACTIVE SERVICE.—Sgt. M. R. Aston; P/O. H. D. Belsher; Sgt. N. E. Bratt; Flt. Sgt. F. L. Denham; Sgt. G. A. Hiddleston; Sgt. D. Lingard; Sgt. P. A. Naylor; Sgt. R. S. Norris; Sgt. C. W. Robinson; Sgt. B. T. Scammel; Sgt. R. Sneesby; Flt. Sgt. W. J. Stevens.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. G. K. Cameron; L.A/C. P. S. Glover; L.A/C. S. D. Turner; Sgt. A. E. Wells.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. A. E. G. Harris; Sgt. M. G. Hawkins.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—P/O. K. R. Russell.

DIED ON ACTIVE SERVICE.—L.A/C. A. J. M. Bird; Cpl. H. B. Brown; Cpl. A. V. S. Chapman; L.A/C. E. A. Clews; W/O. C. E. Cresswell; F/O. J. M. Davidson; A/C.2 N. V. Gregson; L.A/C. J. M. Kelly; Cpl. F. Lardeau; Flt. Lt. A. Melrose; L.A/C. C. J. F. Morgan; Sgt. L. H. Mutter; A/C.1 S. J. Parris; L.A/C. R. J. Pearce; Sgt. F. V. Prime; Sgt. C. H. Roberts; L.A/C. J. O. Roberts; A/C.2 W. Ross; Act. Cpl. E. Sanderson; Cpl. F. Sharp; L.A/C. W. A. White; L.A/C. H. J. Wilson.

Royal Australian Air Force

KILLED IN ACTION.—Sgt. B. S. Braybrook; Sgt. N. G. B. Flitcroft; Sgt. L. M. McDonnell; Sgt. J. C. Plummer.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. G. R. Dibbs; Sgt. E. H Henderson; P/O. A. R. Menzies; P/O. B. T. Nossiter; F/O. E. C. Parton.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. M. G. Banbury; Flt. Sgt. E. T. Hiskens.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. R Croxton-Davis; Sgt. J. A. Brock; F/O. E. N. W. Gray.

MISSING.—P/O. L. F. J. Brown; Sgt. N. F. Conklin; Sgt. C. R. Craven; F/O. C. H. Joseph; P/O. W. H. Moore; Sgt. S. R. Nowlan; Sgt. T. W. Page; P/O. D. R. Rich; F/O. G. C. Sharp; Sgt. F. B. Shaw; Sgt. G. Stooke; Flt. Sgt. W. H. Teede.

KILLED ON ACTIVE SERVICE.—P/O. H. J. Andrews; P/O. M. K. Cummings; Sgt. M. W. Hutchings; Sgt. H. W. Luker; Sgt. H. G. Yeo.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. W. Brodie; F/O. B. L. P. Pollock.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. G. E. Milligan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. B Craig; Sgt G. I. Fee; Flt. Sgt. R. W. Forman; Sgt. W. A. Henschel; F/O. A. F. Izzard; Sgt. D. A. Mitchell; Sgt. J. T. Reid; Sgt. F. A. Youmans.

MISSING BELIEVED KILLED IN ACTION.—P/O. R. J. L. Fowler; Sgt. M. P. Kimber; P/O. C. Murray; Sgt. W. Pearson; Sgt. C. W. Price.

MISSING.—Flt. Lt. G. H. Cheetham; P/O R. E. Currie; Sgt. E. W. Davidson; Sgt. J. W. D. Hoey; Sgt. J. W. Kucinsky; P/O. W. C. Lawrence; F/O. J. G. MacKay; Sqn. Ldr J. P. McMillin; Sgt. M. H. Moore; P/O. M. Shvemar; Sgt. C. H. Sinclair; F/O. L. W. Somers; Sgt. L. F. Sparling; Sgt. W. A. Sparrow; P/O. J. R. Thurlow; Sgt. J. H. Walton; P/O. R. F. Worthington.

KILLED ON ACTIVE SERVICE.—Sgt. J. W. Feagan; P/O. C. P. Meredith; Sgt. J. S. Rennick; Sgt. E. Salmers; Flt. Sgt. T. J. Shields; Sgt. N. G. Smith; Sgt P. Soluk; Sgt. R. A. Taylor.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. W. Gregory.

DIED ON ACTIVE SERVICE.—P/O. J. C. Fraser.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. E. Graham; Sgt. M. V. Tate.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. V. D. James; F/O. L. G. Mee.

MISSING, BELIEVED KILLED IN ACTION.—P/O.

DELAYED DROP: W/O. F. D. C. Brown (right) had to bale out over Burma at a great height. He lost consciousness and fell some 20,000ft. before coming to and opening his 'chute. On the left is L.A/C. J. N. Powell who packed the parachute.

R. V. P. Hopkins; Flt. Sgt. K. F. Morrison.

MISSING.—F/O. A. E. Boulton; Flt. Sgt. E. W. J. Collingwood; Flt. Sgt. G. Henderson; Flt. Lt. F. Hilton, D.F.C.; Act. Sqn. Ldr. A. M. Hobbs, D.F.C.; Flt. Sgt. L. Petersen.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. N. G. Cromie; Flt. Sgt. B. P. Horrobin; Flt. Sgt. J. B. Lindup.

Casualty Communiqué No. 275.

Of the names in this list, 104 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Sgt. J. C. E. Clarke; Sgt. D. H. Clinch; Flt. Sgt. W. Cooke; Sgt. F. Danby; Sgt. A. H. Gurry; Sgt. N. R. Holledge; P/O. J. H. Petrie; F/O. A. W. S. Young.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. P. W. Adams; Sgt. A. C. Burgess; Flt. Sgt. M. I. Gass; Sgt. C. E. Hollingworth; P/O. D. P. Pollock; Sgt. W. Scobie.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. E. W. Baldwin; Sgt. P. P. Bannerman; Sgt. E. Bradley; Sgt. G. F. Bush; Sgt. H. R. Clark; Sgt. E. Cooper; Flt. Sgt. R. A. Cunningham; Flt. Lt. G. N. Dawson; Sgt. J. W. Dawson; F/O. J. R. Drake; Sgt. K. J. Garrett; Sgt. R. E. R. Harries; Sgt. G. W. A. Higson; F/O. D. K. Hulme; Sgt. C. F. James; Sgt. R. G. Mercer; Sgt. R. H. Morris; Sgt. T. H. Parker; Sgt. G. J. Phillips; Sgt. E. R. Phillipson; F/O. J. L. Rowe; Sgt. G. H. Sadler; Sgt. J. Speed; Flt. Lt. A. P. V. Strachan; Sgt. D. H. Tarver; Flt. Sgt. P. W. Tucker-Feltham; P/O. C. R. H. Underwood; Sgt. L. C. Willey; Flt. Sgt. R. Williams.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. C. F. Chambers; P/O. M. O. L. Naper; Flt. Lt. I. White; Sqn. Ldr. C. L. Wright.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. H. Alexander; P/O. L. A. Angell; Sgt. M. H. Burston; Sgt. D. D. Cuthbert; Sgt. W. A. Davies; Flt. Sgt. D. W. C. Fletcher; Sgt. J. Galloway; F/O. W. McC. Girdwood; Sgt. B. Howe; Sgt. G. Hull; Sgt. E. Jeffs; Sgt. G. G. Kitson; Sgt. E. Lidster; Sgt. A. E. McWilliams; Sgt. R. Metcalfe; Sgt. A. D. Pain; Sgt. A. M. Park; Sqn. Ldr. T. H. V. Pheloung; Sgt. W. J. Randall; Sgt. G. A. Robinson; Sgt. H. Rocknean; P/O. C. P. St. Leger; Sgt. E. Stanley; Sgt. P. V. Tanner; P/O. G. G. Tebble; Sgt. G. J. D. Thompson; Sgt. R. G. Winchester; W/O. H. E. Wood; P/O. G. R. Wright.

MISSING.—Sgt. J. Aitken; Sgt. W. Anderson; Sgt. J. N. Angus; Sgt. H. F. Barham; Flt. Sgt. M. Baxter; Sgt. W. F. Biggs; Sgt. A. J. Boar; Sgt. E. A. Bowman; Sgt. D. Brooke; P/O. D. F. P. Brown; Sgt. G. W. Brown; Sgt. W. G. Brown; Sgt. D. McD. Buchan; Sgt. A. Burgess; Sgt. F. Burton; Sgt. R. Cooper; Sgt. A. A. Crank; Sgt. L. F. C. Day; Sgt. J. Denholm; F/O. H. J. Dothie; Sgt. W. T. Dunning; W/O. R. Durham, D.F.M.; Sgt. G. A. P. Edwards; Sgt. W. I. Ettle; Sgt. E. H. Fisher; Sgt. S. G. B. Hayes; Sgt. F. J. H. Heathfield; Sgt. J. C. Hesketh; Sgt. G. A. Hill; Sgt. D. V. Jordan; Sgt. W. H. Jordan; Sgt. D. G. Keane; Sgt. J. A. Keighley; Sgt. L. F. King; Sgt. G. A. Livett; P/O. J. McCrossan, D.F.M.; Sgt. D. E. McGill; Sgt. W. J. McKay; F/O. H. Mappin; Flt. Sgt. H. Martin; Sgt. J. K. Morgan; Sgt. G. B. Mycock; Sgt. H. C. W. Nash; F/O. A. A. Norrie; Sgt. J. A. Ottey; Sgt. T. R. Pagett; Sgt. W. J. Parks; Sgt. C. W. Payne; Flt. Sgt. W. F. Payne; Sgt. W. A. Poulton; F/O. D. J. Prytherch; Sgt. L. J. Ray; Sgt. J. Richards; Sgt. G. W. Rockwood; Sgt. A. Shacklady; Sgt. M. D. Shakespeare; Sgt. A. H. Sheppard; Flt. Sgt. J. F. Smith; Sgt. G. L. Stewart; Sgt. H. R. Stone; Sgt. J. Sutcliffe; Sgt. J. S. Taylor; Sgt. D. A. Thomas; Sgt. C. F. Trott; P/O. F. W. Tomlins; Sgt. F. W. Turner; Sgt. R. O. Vaughan; Sgt. R. W. Warhurst; Sgt. J. Watson; Sgt. E. G. Westall; Sgt. C. E. Wiggett; Sgt. J. T. Wilkinson, D.F.M.; Sgt. F. J. Willett; Sgt. E. Wright; Sgt. A. McD. Young; F/O. C. W. R. Young.

KILLED ON ACTIVE SERVICE.—Sgt. J. Blackie; Sgt. J. E. Mosley; A/C.1 C. F. Putt; L.A/C. W. C. Smith.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. G. M. R. Fairweather; P/O. J. W. Southall.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. F. H. Edwards; Flt. Sgt. W. G. Moore; Sgt. F. A. W. Nice.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. M. J. Cassidy; F/O. J. R. Stace; Sgt. J. Wildridge; Sgt. E. F. Woodruff.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. J. Dixon; Sgt. H. T. Green; Sgt. B. Kitchen; Sgt. K. Simpson.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. D. J. Good; Sgt. J. A. S. Hulme.

DIED ON ACTIVE SERVICE.—L.A/C. W. Anderson; L.A/C. A. E. Beavan; L.A/C. H. R. Charles; L.A/C. H. R. Giles; A/C.1 H. Hamer; L.A/C. A. J. Herbert; L.A/C. G. F. Hollman; A/C.2 J. Hook; A/C.2 D. C. Jex; A/C.2 M. H. Jupe; A/C.2 P. F. Leddy; F/O. H. L. Owen; A/C.2 R. Partington; A/C.1 S. F. Proudley; A/C.2 N. Walker; L.A/C. J. L. Walter; L.A/C. R. T. Whitehead.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—P/O. R. J. Beldin; Sgt. S. Biggs; Sgt. T. L. Brown; F/O. G. C. Fletcher; Sgt. F. E. Holmes; Sgt. G. A. Jones; Sgt. J. R. Jones; P/O. C. C. Lee; Sgt. R. Newdick; Flt. Sgt. T. G. O'Shaughnessy; P/O. H. J. D. Rowse; Sqn. Ldr. R. J. Sage, A.F.C.; Sgt. G. D. W. Scholes; P/O. P. P. Stevens; Act. Flt. Sgt. F. W. Vincent; Sgt. T. Whitehead.

FOR HIGH STAKES? Fleet Air Arm pilots playing nap in a decompression chamber at an equivalent height of 35,000ft.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/C.W.2 A. Knox.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. G. F. Dare.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—P/O. J. W. Upward.

WOUNDED OR INJURED IN ACTION.—F/O. M. L. Burke.

MISSING, BELIEVED KILLED IN ACTION.—P/O. J. K. Somers.

MISSING.—Sgt. A. Gordon; Sgt. D. C. P. Lundie; P/O. P. R. Quance; F/O. B. J. Sheehy.

Royal Canadian Air Force

KILLED IN ACTION.—Sgt. R. E. MacDonald.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. C. W. Austin; P/O. J. D. Ernst; Sgt. W. S. Grant; Sgt. C. A. Kitson; Flt. Sgt. W. F. Murray; Sgt. C. A. Paton; Flt. Sgt. J. G. St. Louis.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. M. W. Atkinson; Sgt. D. S. Benner; Sgt. S. G. E. Dunn; P/O. R. J. Elliott; Sgt. A. I. Ellis; P/O. D. R. Gill; P/O. L. E. Hokan; Flt. Sgt. K. R. Jackson; Flt. Sgt. J. B. Lawrence; Sgt. F. E. E. Lyons; Flt. Sgt. A. O. MacLeod; Sgt. S. McMenony; Flt. Sgt. J. D. R. Menard; Sgt. R. J. Peters; P/O. C. W. Reaume; Sgt. M. F. Robbins; Flt. Sgt. C. P. Shriner; P/O. F. J. Taylor; Flt. Sgt. T. M. Terris; Sgt. R. J. Thompson; Flt. Sgt. E. F. H. Truby; Sgt. H. R. Williamson; P/O. G. D. Woolrich.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. L. Kirstine.

MISSING, BELIEVED KILLED IN ACTION.—F/O. H. G. Handley; Sgt. J. J. F. Holland; Sgt. H. G. Watson; Sgt. G. C. Wickson.

MISSING.—Sgt. J. R. Archambault; P/O. C. M. Bingham; Sgt. G. E. Bisbee; P/O. H. A. Brown; Sgt. A. S. Davidson; Sgt. J. P. Dockerill; F/O. A. B. C. Durnell; P/O. J. C. Elliott; P/O. D. C. Horner; Sgt. M. L. Hutchins; Sgt. J. E. Lewis; Sgt. J. C. MacDonald; Sgt. G. M. McLean; P/O. F. C. McWilliams; Sgt. R. H. Masters; P/O. J. E. Monahan; P/O. G. E. Pridham; Sgt. C. C. Reichert; Flt. Lt. M. Samuels; Sgt. W. Searle; Sgt. C. L. Sebelius; Sgt. W. D. Walsh; Sgt. K. D. Windsor.

KILLED ON ACTIVE SERVICE.—P/O. J. M. Brown.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. A. J. Cockaday.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. M. W. Dixon.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. A. G. Brown; Flt. Sgt. G. E. Dale; Sgt. J. W. Henry; Sgt. D. Newman; Sgt. T. W. Peacock.

MISSING, BELIEVED KILLED IN ACTION.—P/O. W. T. Ellis; Flt. Sgt. C. R. Pearce, D.F.M.; P/O. E. L. Robson.

MISSING.—F/O. G. W. Brewer, D.F.C.; Flt. Lt. A. W. Doel; Flt. Sgt. R. F. Edmonds; F/O. O. K. Jones; P/O. J. A. Marson; P/O. C. H. Robinson; W/O. H. W. Secord; Flt. Sgt. O. K. Whyman.

KILLED ON ACTIVE SERVICE.—P/O. K. Clift.

South African Air Force

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—2/Lt. Habergham.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—2/Lt. D. T. S. King.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Capt. J. J. Orr.

Casualty Communiqué No. 276.

Of the names in this list 93 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. S. Greenbeck; P/O. J. G. Newman; P/O. H. M. Stoffer.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. K. F. Edwards; Sgt. T. Gill; Sgt. J. J. Glendenning; Sgt. G. Green; Flt. Sgt. R. C. Morris; P/O. J. McL. B. Scott.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. F. J. Adams; Sgt. F. Adey; Sgt. R. F. Ansell; Sgt. P. Barr; Sgt. R. Bodi; Sgt. T. E. Brett; Sgt. R. Brooker; Sgt. C. J. Broomhead; Sgt. T. B. Brown; Sgt. J. Buchanan; Sgt. G. T. Canterbury; P/O. G. W. Evans; Sgt. A. Fairless; P/O. A. S. Hawkins; Act. Sgt. H. A. Heathcote; F/O. S. T. Hewitt; Sgt. E. J. Hindley; Sgt. B. Holloway; Flt. Lt. H. M. Jones; Sgt. E. A. J. King; Sgt. D. C. Marsh; Sgt. D. L. Osborne; Sgt. H. L. Pitchforth; Sgt. N. R. Sedgwick; Sgt. L. R. Sheward; Act. Sgt. T. C. Smith; P/O. J. L. Spence; Sgt. E. H. Tytherleigh; Sgt. B. W. Vaughan; P/O. J. H. Vincent; Flt. Sgt. H. E. Webber; Sgt. R. Wilson; Flt. Lt. K. F. J. Winchester; Sgt. V. Young.

WOUNDED OR INJURED IN ACTION.—Sgt. H. L. Allinson; Sgt. A. H. Parker.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—Sgt. D. A. K. Hyde; Sgt. P. G. Spreckley.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. B. R. Cripps; Sgt. C. W. Dudley; W/O. P. D. Hendra; P/O. I. R. Hillan; Sgt. K. W. H. Johnson; Flt. Sgt. K. P. O'Dowd; P/O. C. S. Olson; Sgt. G. D. Sharp.

MISSING.—Sgt. F. T. Adams; W/O. E. J. T. Altham; Sgt. L. Ashworth; F/O. A. S. Barrie; Sgt. W. H. Bartlett; Sgt. J. E. Beedles; Sgt. J. W. Bembridge; Sgt. T. Bennett; P/O. S. Blackhurst; Sgt. R. Bradshaw; Sgt. N. J. Brokenshire; Sgt. S. K. Brown; Sgt. A. G. Bryan; Sgt. J. S. Callcut; Sgt. G. Cameron; P/O. J. Carrie; Sgt. G. C. Chapman; P/O. J. Cheney; P/O. H. J. Clelland; Sgt. L. E. Coker; Sgt. J. Conway; Sgt. K. A. C. Cotton; Flt. Sgt. J. S. F. V. Crawley; F/O. M. G. Curtis; Sgt. A. F. S. Day; Act. Flt. Lt. W. T. Dean; Act. Flt. Lt. F. De Naeyer; Sgt. K. Denness; Sgt. E. A. Duchene; Sgt. H. A. Dunn; Sgt. W. Dunn; P/O. J. M. Dymock; Sgt. R. H. Elliot; P/O. D. V. Elliott; Flt. Sgt. S. C. Everitt; Sgt. J. Fitzsimmons; Sgt. D. Floyd; Sgt. F. F. Foden; Sgt. A. G. H. Ford; Sgt. T. R. Forester; Sgt. B. J. Fosh; P/O. W. R. Gardiner; Sgt. E. W. Geraghty; Sgt. W. H. Gordon; F/O. D. M. Grant; Flt. Sgt. R. J. Green; Sgt. W. R. Green; P/O. E. Griffiths; F/O. E. G. Grove; Sgt. F. Hawes; F/O. P. G. Herrin; Sgt. J. T. Hindley; Sgt. A. K. Hodges; Sgt. F. Holmes; Sgt. E. J. H. Hopkins; Sgt. B. Huke; Sgt. C. Hunt; Sgt. J. M. Hurson; P/O. J. Hutchison; Sgt. G. C. Hutton; Sgt. J. Imms; P/O. F. R. Johnson; Sgt. R. L. Johnson; Sgt. J. W. M. Jones; Sgt. A. F. Kellett; Flt. Sgt. D. H. R. Kelly; Sgt. S. W. Kennedy; Sgt. G. F. Kilsby; P/O. G. Kleinberg; Act. Flt. Lt. E. A. J. Laver; Sgt. G. Lockey; Flt. Lt. J. C. Lowe; Sgt. T. W. C. Luther; Sgt. W. C. Macauley; Sgt. E. L. McVitie; Sgt. K. A. Maddock; Sgt. G. A. H. Male; Flt. Sgt. J. J. Mansfield; F/O. E. W. Marsden; Sgt. C. J. Matthews; P/O. R. A. C. Maund; Sgt. H. R. Mears; Sgt. P. Mills; P/O. J. K. Mycock; Sgt. J. W. Newport; Sgt. W. R. Newton; Sgt. F. T. Nuttall; Sgt. T. Ogle; Sgt. S. Payton; Sgt. E. H. Pearson; Sgt. R. M. Pinkerton; P/O. E. J. Plumridge; Sgt. A. E. Ponsford; F/O. W. Randolph; Sgt. J. Reid; Act. Sqn. Ldr. P. J. E. Ritchie, D.F.C.; Sgt. R. Robertson; Sgt. M. E. Rust; P/O. R. Rust; Sgt. R. J. Sage; Sgt. K. F. Shaw; Flt. Sgt. E. H. Skeel; Sgt. W. P. Smith; P/O. W. S. Smith; F/O. A. D. Sommerville; Sgt. E. C. Stally; Sgt. A. F. B. Stanton; Sgt. R. A. Thomas; Sgt. W. Thomlinson; Sgt. R. O. Tudberry; P/O. D. I. Turner; F/O. H. L. Walmsley; Sgt. W. Waring; Sgt. M. Webster; Sgt. J. Westbarn; Sgt. N. G. Whiting; Sgt. D. E. Williams; Sgt. F. H. Williams; Sgt. S. Williams; F/O. J. E. Wilson; F/O. R. W. Winfield; P/O. W. H. Wood; F/O. J. E. Wootton.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. T. E. Doherty.

KILLED ON ACTIVE SERVICE.—Sgt. L. A. Greene; Sgt. H. F. Hunter; L.A/C. N. H. King; Flt. Lt. G. T. Langley; P/O. P. Miller; Act. Sgt. J. R. Murray; Act. Sgt. A. Paton; F/O. J. Reade; Sgt. P. P. Tye.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. W. B. Wilkie.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Sgt. M. S. Kemp.

SERVICE

DIED ON ACTIVE SERVICE.—L.A/C. C. A. Beardall; L.A/C. H. J. Butcher; Sgt. T. J. Campbell; W/O. H. H. Chapman; L.A/C. T. Dixon; A/C.2 S. B. Feakins; A/C.2 A. Griffiths; A/C.1 A. A. Gunn; A/C.1 P. F. Lawrence; A/C.2 W. Lendon; L.A/C. G. Lotherington; L.A/C. F. P. Matthews; L.A/C. W. D. Parry; L.A/C. R. Spicer; L.A/C. P. D. Thurston.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. M. Clarke; Sgt. N. A. Hobden; Flt. Sgt. L. E. J. Humber; Sgt. S. V. F. Hurrell; Act. Flt. Lt. G. J. Lynes; Sgt. C. J. Price; Sgt. S. G. Reed; F/O. F. J. Roder; F/O. M. E. Zillessen.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—L.A/CW. B. I. Howl.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. R. L. Cumberland; Sgt. J. T. Philpot.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. D. Canet; Sgt. N. R. Jones; Sgt. G. H. Shannon; Flt. Sgt. C. A. Woods.

MISSING.—F/O. R. B. Albon; Flt. Sgt. L. E. Cavanagh; F/O. L. E. Harrison; P/O. R. J. Hefferman; Sgt. R. J. Lockrey; F/O. G. Silva, D.F.C.; Flt. Sgt. E. A. Sims; Act. Air Comdre. D. E. L. Wilson; Flt. Sgt. J. T. Winterbon.

KILLED ON ACTIVE SERVICE.—Sgt. D. S. McDonald.

WOUNDED OR INJURED ON ACTIVE SERVICE.—F/O. N. H. Todd.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. M. H. Buckley; P/O. F. L. Cunningham; Sgt. T. McL. M. Hunter; Flt. Sgt. D. G. H. Johnson; Sgt P. Kucheryk; Sgt. A. A. Lang; F/O. J. W. McCann; W/O. E. W. Murphy.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. W. C. Black; F/O. J. H. Carrick; Flt. Sgt. R. H. Culp; P/O. W. H. Duncan; F/O. G. M. Gillies; Flt. Sgt. C. W. Hall; Sgt. A. H. Hansford; Sgt. A. K. Hodgins; Sgt. J. A. Hollinsworth; P/O. T. F. Lamb; Sgt. I. C. Lamont; Flt. Sgt. A. D. MacDonald; Sgt. C. H. McPherson; P/O. I. A. J. McQueen; Sgt. P. J. Maroney; Sgt. C. E. Pickard; Sgt. J. J. Pocock; Sgt. H. M. Russell; Sgt. W. W. Waddell; Sgt. W. R. Waddle; Sgt. A. C. Walland.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. P. J. A. Dennis; Sgt. J. D. Hamilton; Sgt. J. J. Reansbury.

MISSING.—P/O. G. W. Armstrong; Sgt. J. F. K. Crowe; Sgt. J. J. G. Damboisc; Sgt. J. B. S. P. H. David; F/O. W. H. Flatt; F/O. R. B. Harris; Sgt R. G. Jacobs; Sgt. T. L. Macaskill; P/O. C. A. Mayhew; Sgt. W. C. Moran; Flt. Lt. A. E. Spurr; Sgt. O. D. Thompson; Sgt. O. W. Todd; Sgt. G. L. Tyrone.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. J. G. Pelletier.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Sgt. H. W. H. Adams; Sgt. J. L. T. Chartier; Sgt. J. R. Coffey; Sgt. E. R. Hutton; Sgt. J. E. Oatway.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. G. Thom; F/O. G. W. Wiley.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. H. Moller.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Sgt. L. E. Workman.

MISSING.—Flt. Sgt. K. A. Burbidge; Flt. Sgt. A. W. Crozier; F/O. L. J. Gwynne; F/O. J. V. Hawkins; Flt. Sgt. A. J. McEwin; Flt. Sgt. D. E. Martin; Flt Sgt. D. J. Tickle; Flt. Sgt. W. F. Wilcockson.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Sgt. D. K. H. McDonald.

Casualty Communiqué No. 277.

Of the names in this list 88 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Sgt. W. A. Davis; Flt. Sgt. E. C. G. Jackman; Sgt. K. Lloyd; Sgt. R. S. C. Plowright; Sgt. R. F. Stay; Sgt. E. K. Ticklepenny.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. F. G. Allen; Sgt. R. Bayley; Sgt. J. Beveridge; F/O. N. J. Briant; Sgt. G. J. Chambers; Sgt. J. R. Dawson; Sgt. A. H. J. G. Desmond; Flt. Sgt. J. L. Greening; Flt. Sgt. D. H. Harries; P/O. K. H. Harrison, D.F.M.; P/O. P. C. V. Joslin; Sgt. K. O. MacKay, D.F.M.; Flt. Sgt. E. J. May; Sgt. A. E. Messer; Sgt. E. C. Mowforth; Sgt. A. E. Musgrave; Flt. Lt. H. Rhoden; Flt. Sgt. F. A. Robinson; Sgt. B. H. Thomas; Sgt. E. Walton; Sgt. A. G. Willans; Sgt. A. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. F. A. Andrews; Flt. Sgt. C. H. Barrow; Sgt. A. J. J. Brooks; Sgt. G. Brothwell; P/O. J. H. Burgess; Flt. Sgt. L. R. Clarke; P/O. A. R. Cook; Sgt. J. Curle; Sgt. A. J. Cusworth; Sgt. C. Dodds; Sgt. T. E. Donnelly; Flt. Sgt. R. S. Fraser; P/O. D. F. Fitzgerald; Flt. Sgt. L. Hartley; Sgt. S. H. Jackson; Flt. Lt. D. Laing; Sgt. R. H. Lucas; Sgt. R. Moore; P/O. C. Neve; P/O. I. C. Newell; Sgt. H. T. Ramsden; Sgt. A. V. Riggs; Sgt. S. B. Ronaldson; F/O. B. G. H. Smith; Sgt. T. F. Thompson; Sgt. K. T. Turvey; Sgt. J. J. Watson; P/O. N. A. G. Wilberforce; Sgt. D. E. Williams; Sgt. G. C. Willis.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW REPORTED KILLED IN ACTION.—Sgt. S. G. Twine.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. J. E. O'N. Cassell; Sgt. G. R. S. Cayless; Sgt. J. R. Fast; Sgt. J. G. Hole; Sgt. W. P. Hollick; P/O. J. D. Humphreys; F/O. H. J. Lumb; Sgt. H. H. Mooney.

MISSING.—W/O. J. Allen; P/O. R. L. Amesbury; Sgt. T. M. Atkinson; Sgt. E. G. Baker; Sgt. F. E. Baker; Sgt. T. Ball; Sgt. R. A. Barlow; Sgt. T. G. Barton; Sgt. F. L. Beeston; Sgt. L. Bennett; Sgt. P. Blundell; Sgt. S. T. Booth; Sgt. G. V. Branson; Sgt. T. G. Brook; Sgt. W. A. Bush; Sgt. C. D. H. Campbell; Sgt. B. H. Church; Sgt. G. W. Colyer; F/O. A. V. I. Cook; Sgt. C. Connah; Sgt. A. Corns; Sgt. R. J. Dash; Sgt. J. C. Davidson; F/O. D. H. V. Davis; Sgt. W. T. Davis; Sgt. J. Dillon; Sgt. W. F. Eades; Sgt. F. W. Ealden; Sgt. J. Emerson; Sgt. J. C. Evans; Sgt. A. W. Fairmaner; P/O. A. L. Ford; Flt. Sgt. R. C. Garton; P/O. P. J. Gladman; Sgt. P. Glover; Sgt. J. Goldfluat; Sgt. R. E. Goodyear; P/O. C. E. L. Grant; Sgt. E. Green; Sgt. G. C. Green; Sgt. E. R. H. Griffiths; Sgt. A. H. Hawes; Sgt. G. Hay; Sgt. G. R. Hazell; Sgt. J. Hetherington; P/O. C. W. Hewitt; Sgt. W. W. Hilditch; Sgt. G. R. Hill; Sgt. G. S. Hodges; Sgt. R. L. Hollywood; Sgt. A. L. T. Hosking; P/O. D. G. Howse; Sgt. B. Huggan; Sgt. W. E. Hughes; Sgt. F. J. Hunter; Sgt. G. R. Johnson; P/O. L. A. Johnson; Flt. Sgt. T. Johnstone; Sgt. K. W. Langstaff; Sgt. W. C. Lewis; Sgt. A. D. McFarlane; Sgt. W. McI. McGowan; Sgt. J. McIlhatton; Sgt. F. MacLeay; F/O. A. J. Manning; Flt. Lt. C. C. Marshall; Sgt. R. W. Mepsted; Sgt. F. Mills; Sgt. T. D. Milnns; Flt. Lt. C. R. Moody; Sgt. N. H. Morris; Sgt. A. Mortimer; Sgt. G. C. Mortimer; Sgt. C. C. Mould; Sgt. N. S. Mould; Sgt. D. C. Oliver; Sgt. B. D. O'Neil; P/O. A. B. Orme; Sgt. A. Osmond; F/O. G. W. E. Paddock; Sgt. J. W. Palmer; P/O. F. Parry; Sgt. N. R. Parry; F/O. E. H. Patrick; Sgt. G. H. W. Peach; P/O. G. W. Pollard; Sgt. L. F. Price; Sgt. J. Priestley; Sgt. R. Pugh; Sgt. R. F. Rashley; Sgt. J. Redman; Act. Flt. Lt. D. H. Reid; P/O. C. B. Reynolds; F/O. C. P. Reynolds; Sgt. A. H. Richardson; Sgt. E. R. Richardson; Sgt. J. Roberts; Sgt. J. Roison; Sgt. A. McG. Sandars; P/O. E. H. Sandell; Sgt. B. L. Scott; P/O. D. M. Sharp; Sgt. C. M. Sibbald; F/O. A. R. Sinton; P/O. N. B. Smythe; Sgt. J. H. W. Snowden; Sgt. H. Squire; Flt. Sgt. K. C. Starmer; Flt. Sgt. D. MacL. Struthers; Sgt. D. Telfer; Sgt. R. H. W. Thompson; Sgt. W. H. Thompson; Sgt. P. W. Thornycroft; F/O. D. Towers; Sgt. H. J. Toze; P/O. H. J. Trafford; P/O. J. F. Tritton; Sgt. W. E. Walter; F/O. W. J. Wheeler; Sgt. F. A. Whitehead; Sgt. E. Wilson; Sgt. G. E. Wilson; Sgt. P. J. Wood; Sgt. A. Worsdale.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Sgt. W. C. Lawson.

KILLED ON ACTIVE SERVICE.—F/O. D. W. Manney; Act. Sgt. S. B. Marcis; Flt. Sgt. G. R. Turkington.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—L.A/C. D. P. A. Hunt; Upl. R. E. Springer; L.A/C. W. R. J. Stubbs; L.A/C. R. J. Wright.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. P. A. Jupp.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW REPORTED KILLED ON ACTIVE SERVICE.—Sgt. A. A. Chambers.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. R. A. Armitage; P/O. C. E. Emberson; Sgt. A. J. Keep.

DIED ON ACTIVE SERVICE.—A/C.2 N. Daniels; L.A/C. L. O. Howe; L.A/C. G. Jones; A/C.1 H. E. Smaylan.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. R. H. Adams; Sgt. F. J. Baker; Sgt. D. W. Chambers; Sgt. A. Ford; Sgt. R. C. Link; F/O. G. K. W. Newton.

Royal Australian Air Force.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. L. C. Dorward; Sgt. D. A. Milligan.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. J. Johannesen; Sgt. J. E. F. Martin.

MISSING.—Flt. Sgt. A. B. R. Airy; Flt. Sgt. I. W. Banks; Flt. Sgt. R. F. W. Clark; Flt. Sgt. R. I. Gates; Sgt. F. L. I. Hill; Act. Flt. Lt. F. C. McKenzie; Flt. Sgt. C. A. Mattrass; Flt. Sgt. L. J. Naile; Flt. Sgt. L. A. Pearce; F/O. W. E. Riley; Sgt. H. K. Smith; Sgt. A. W. Teerman.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Flt. Sgt. R. N. Lindsay; P/O. J. J. Maguire.

Royal Canadian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. H. Forsyth; Flt. Sgt. E. C. McLean; Sgt. W. Pedersen; Sgt. F. P. Quinn; Flt. Sgt. E. St. A. Richardson; F/O. D. F. Teague.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. F. C. Adsett; Flt. Sgt. C. J. H. Fry; Sgt. W. S. Rausch.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED IN ACTION.—Sgt. D. A. Watson.

MISSING.—P/O. J. H. Addison; Sgt. C. P. Beairsto; P/O. J. O. R. Bonefant; P/O. G. A. Cadmus; F/O. D. A. Carmichael; Sgt. T. W. J. Copeland; P/O. G. Davidson; Sgt. A. D. Deane; P/O. E. O. Findlay; Flt. Sgt. H. G. Fronde; Flt. Sgt. F. J. Higgins, D.F.M.; Sgt. J. O. Hills; Sgt. W. Kashmar; Flt. Sgt. J. C. A. Laberge; F/O. J. S. MacIntyre; F/O. J. B. Mann; F/O. G. T. Matynia; P/O. M. M. Meyer; Sgt. J. W. Robertson; Wing. Cdr J. L. Savard, D.F.C.; P/O. W. A. Sneath; Sgt. R. R. Stickney; F/O. G. T. Vicary; F/O. J. H. Watlington; Sgt. K. B. Wood; Flt. Sgt. A. K. Young.

Royal New Zealand Air Force

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. R. N. H. Jones; P/O. C. J. McKeen; Sgt. G. W. Martin; Sgt. G. Nelson.

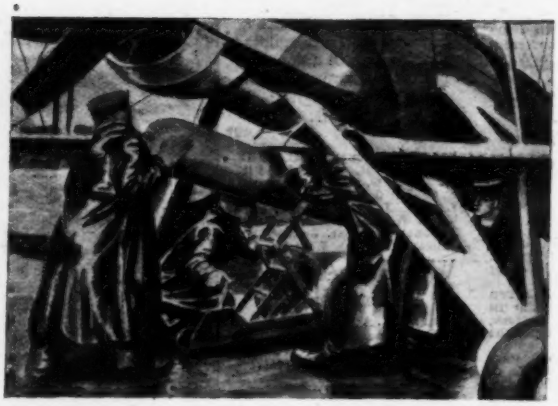
MISSING, BELIEVED KILLED IN ACTION.—P/O. F. M. McKenzie; Flt. Sgt. G. D. Thomson.

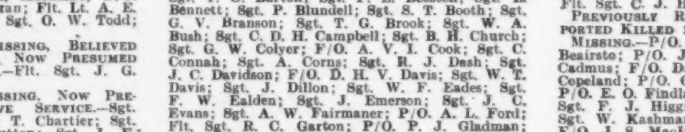
MISSING.—Flt. Sgt. J. F. Blank; Flt. Sgt. B. B. Broadhead; Flt. Sgt. E. W. McGonigal; Flt. Sgt. C. Moneur; F/O. K. A. Neilson; F/O. W. R. Perrott; Flt. Sgt. L. G. Porritt; Flt. Sgt. A. E. West; Flt. Sgt. C. J. Whitelaw.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Sgt. G. M. D. Hyde.

South African Air Force

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—Lt. P. Campbell; Air Sgt. S. A. Marits.



R. V. Pitchforth's watercolour "Loading Torpedo on Swordfish" in the collection of war pictures in the National Gallery.

AVIATION